FOREIGN
BROADCAST
INFORMATION
SERVICE

JPRS Report

DISTRIBUTION STATEMENT A
Approved for public release
Distribution Unlimited
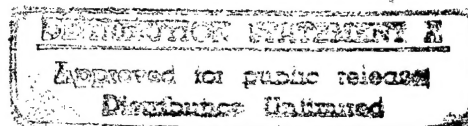
Science & Technology

Europe

19980123 088

DTIC QUALITY INSPECTED 3

CONTENTS

COMPUTERS

LASERS, SENSORS, OPTICS

AEROSPACE, CIVIL AVIATION

France: Conference on Microgravity R&D

SEP: Equipment

90CW0041 Paris CONFERENCE ON
MICROGRAVITY: SPACE & INDUSTRY
inFrench18 Apr 89 pp 1-13

[Paper from Microgravity and Industry Symposium, held 18 April 1989 in Paris, entitled: "Instruments and Technologies Developed by SEP for the Fabrication of Materials Under Microgravity"]

[Text] Introduction

The SEP (European Propellent Company) has special expertise in high temperatures which can naturally be applied to the development of high-temperature instruments and furnaces for conducting scientific or technological microgravity experiments.

Moreover, the particular technologies developed by SEP in the areas of fluid control and very high-performance mechanisms can be applied to the manufacture of high-performance peripheral equipment.

The following chapters describe the broad orientations of the development programs underway and the performance of existing instruments or of those being developed for Columbus.

Development Directions

Because of the special expertise developed in France by experimenters, the SEP has fabricated materials for use in directed solidification (Bridgmann) and vapor-phase growth.

AGHF

Under contract with the European Space Agency and in collaboration with Dornier, the SEP has developed a very advanced instrument for directed solidification: the AGHF (Advanced Gradient Heating Facility).

Its detailed characteristics are indicated in Table 2.1.

It represents significant progress over existing instruments on the Spacelab for the following reasons:

—it has the greatest thermal stability of any existing instrument, = plus or minus 0.2 degrees C at 1400 degrees C.

—the sample can be instrumented very efficiently: it can be marked by "Peltier pulse" and has measurement-collection capacity = as high as 28 thermocouples in the cartridge.

The cartridge can hold samples whose total length is 300 mm and which have diameters of up to 18 mm depending on crucible technology used.

The draft length is 140 mm, with a minimum useful length of 80 mm. The sample is larger because the thermal flow must be sent through the ends of the sample, far from the solidification zone.

The gradient can be adapted to the requirements of the experiment.

For instance, a metallurgy experiment can require a high gradient. In that case, a liquid ring (CNES patent) will be used for energy cooling of the cartridge. The gradient can then attain 100 degrees C/cm for a highly conductive sample ($\lambda.S = 2.5$ W.cm.K^{-1}) and exceed 140 degrees C/cm for a sample of average conductivity (for example Cupro Nickel: $\lambda.S = 1.4$W.cm.IT^{-1}).

In contrast, the manufacture of a gallium-arsenide single crystal requires a low gradient. It will therefore be fabricated between the two heating elements of the diffusor, with the temperature difference between the two elements producing a gradient somewhere in the range of 10 and 30 degrees C/cm.

Multizone Furnace

The multizone furnace is designed to be mounted on the MFA (Multifurnace Assembly).

Seven of them were ordered by the CNES (National Center for Space Studies), four of which are scheduled to fly on EURECA in 1991.

The seven furnaces were designed and manufactured in less than 2 years.

The multizone furnace is intended for use in either vapor-deposition experiments (in that case it is equipped with sodium-vapor heat pipes or diffusion or solidification experiments.

It can operate at up to 900 degrees C with very little electrical power (180W); its temperature stability is excellent, = plus or minus 0.025 degrees C. Unfortunately it is not fully useable in space because of the technological limitations of flight electronics.

Its characteristics are listed in Table 2.2.

Table 2.1

AGHF CHARACTERISTICS FACILITY	
Dimensions	= 28 PU Height
	19 " Width
	612 mm Depth
Weight	= 160 kg

AGHF CHARACTERISTICS FACILITY (Continued)

Input power less than 1200 W	
Water cooling Requirements	= 60 kg/h
Air Cooling Requirements	= 10 + 20 kg/h
FURNACE	
Maximum temperature	= 1400 degrees C
Temperature stability	= plus or minus 0.1 degrees C
Temperature drift	Less than or equal to 7 degrees C in 100 hours
Cooling-zone temperature Stability	= plus or minus 0.3 degrees C
Cooling mode	= by radiation or by conduction
	(liquid-metal ring)
Adiabatic zone length	= 45 mm
PULLING	
Pulling length	= 140 mm
Guaranteed processing length	= 80 mm
Pulling speed	= 0.01 mm/mn to 10 mm/mn
Pulling disturbances less tan 10	$^{-5}$ g from 0 to 1 Hz
CARTRIDGE	
Length	= 375 mm
Diameter	= 20 mm (liquid-metal ring)
	: up to mm (radiative cooling)
Sample length	= 320 mm maximum (including expansion-compensation device)
Sample thermocouples	= 28 max.
Pulse marking capability	up to 30A during 1s.
Possibility of use of crucible-failure detector.	
Example of gradient	= 100 degrees C/cm with $\lambda.S = 2.6.$W.cm degrees C^{-1}.

Table 2.2

MTZ CHARACTERISTICS

Dimensions:	
- height	= 553 mm
- cylindrical body outside diameter	= 105 mm
- pedestal	= 160 mm square
Maximum operating temperature	= 900 degrees C
Temperature stability	= 0.05 degrees C p to p
Maximum steady power at 900 degrees C	= 180 Watt
Maximum power per heater	
During heat-up	= 150 Watt
	(450 Watt total)
Number of isotherm zones	= 3
Length of each zone	= 80 mm
Cartridge =	
Outside diameter	=22.5 mm
Overall length	= 498 mm
Useful length	= 412 mm
Thermocouples	= up to 9.

Research and Technology Furnaces

The SEP is currently building 3 research and technology furnaces:

—a diffusion furnace of SEPCARB (R) composite materials. This furnace has already attained 1800 degrees C in ultrahigh vacuum with power of less than 500 W and has undergone several hundred hours of endurance testing.

The power performance is all the more remarkable as the furnace is functionally and geometrically similar to the AGHF.

—a 2000-degree C metal furnace using more classic technology than the SEPCARB furnace. This furnace is now being built. Its life is predicted to exceed 1,000 hours.

—a laboratory furnace functioning in air at 1500 degrees C is under study.

These three preliminary models will be used in the Columbus instruments described in Chapter 3.

Support for Development of Technological Experiments

Experimental scientists generally develop their experiments themselves. Given the hourly rate of an industrial scientist, it is clear that the number of hours devoted to developing an industrial space experiment must be held down to a minimum.

To accomplish this the SEP and CNES have already planned a certain number of resources to help the experimenter conduct his experiment rapidly.

—small thermal-computation programs for detailed modeling of the temperature field in the cartridge.

—computerized materials' files for quick location of the best materials for a given application.

—an expert system to optimize design of the experimental cartridge.

—test equipment for conducting baseline experiments using a ground model of the instrument.

This installation, controlled by a work station, allows the test to be run and partially analyzed without human intervention.

Future Columbus Instruments

The instruments for Columbus can be used to conduct not only scientific experiments but also technological predevelopments.

To this end, three categories of instruments are planned:

—"Metallurgy laboratory": a double rack containing two furnaces, one capable of holding samples 10 to 20 mm in diameter and of reaching 2000 degrees C, the other capable of holding 30-mm samples and of attaining 1600 degrees C (more specifically designed for semiconductors).

—Directed-solidification instrument for preproduction of semiconductors (sample diameter = 75 mm).

—Contact-free melting instrument that operates through gas-film levitation (AEC concept).

Metallurgy Laboratory

The laboratory treats metals and semiconductors using Bridgmann directed solidification.

It retains the improvements of AGHF (great temperature stability, adequate instrumentation) and in addition offers higher temperatures and larger sample diameters.

Sample changes are automatic (indispensable on the MTFF) and/or robotized.

The laboratory is designed to be repaired or modified in space.

Physically, it occupies a double rack and contains two chambers, one of which is heated while the other is being cooled or loaded.

Verification of the technologies necessary for constructing 2000-degree C furnaces is done on development furnaces.

Semiconductor Preproduction Instrument

Industrial demand will predictably lean more toward the fabrication of 3-5 semiconductor single crystals of useable size, that is 75 mm (3 inches), for the evaluation of microgravity-induced quality improvements in single crystals made on classic microcircuit assembly lines.

Because of the low gradients and low thermal conductivity required, it seems possible to construct such an instrument with acceptable power levels.

Furnaces in Oxidizing Atmospheres

In cooperation with the AEC, the SEP is developing a gas-film levitation furnace capable of functioning at up to 1500 degrees C.

Such an instrument will make it possible to treat oxide glasses and other dielectrics aboard the Columbus without a contract.

More generally, it satisfies an unmet need in the panoply of existing furnaces and makes it possible to treat many materials for industrial use (garnets, etc.) in an oxidizing atmosphere.

Equipment

The SEP has developed or is developing a number of pieces of equipment specially adapted to the functioning of installations that are demanding in terms of microgravity.

Turbomolecular Pump with Magnetic Bearings

This turbomolecular pump—studied in partnership with Leybold—has already flown twice on the Spacelab.

It has a pumping speed of 100 1-S^{-1} and an ultimate vacuum of 10^{-10} m bar.

It enables vacuum furnaces to operate under good conditions and drives the mass spectrometers.

Fluid Circulation Pump

There are already a certain number of centrifugal pumps that circulate freon or water aboard the Shuttle or Spacelab.

They unfortunately cause vibrations that adversely affect microgravity levels.

The SEP is developing new pumps to eliminate these drawbacks. They should be put into service in Hermes and the MTFF (expansion unknown).

Mechanism for Changing Samples

The SEP has developed a sample-changing mechanism for AMF (Automatic Mirror Furnace Facility) manufactured by Dornier and which should fly on EURECA in 1991.

The mechanism can handle 24 tubes and turn the tube if necessary.

Conclusion

The furnaces and instruments developed by SEP are presently the best-performers in their field.

In their advanced versions for Columbus, they can treat all materials for technological use: nickel and titanium alloys, and 3.5 semiconductor metal-matrice materials (AS Ga and InP).

Matra: Applications

90CW0041 Paris CONFERENCE ON MICROGRAVITY: SPACE & INDUSTRY in French 18 Apr 89 pp 14-30

[Symposium paper entitled: "Microgravity Applications"]

[Text]

Technologies and Space Medicine

This European Space Agency program for which Matra is the chief contractor centers on three scientific goals.

—Three-dimensional ultrasound cardiography.

In collaboration with the Spanish company NTE in Barcelona, Professor Pourcelot's Medical Biology Laboratory in Tours, and the Vermon Company, Matra is developing complete ground equipment to demonstrate that the functioning and concept of 3D US cardiography are sound.

—Alternatives to mass spectrometry for the measurement and monitoring of astronauts' cardiac and pulmonary parameters.

In collaboration with the Danish company Damec and several physicians, Matra is studying the credibility of such alternatives, particularly concepts for photoacoustic gas analyzers. A ground model will be developed to demonstrate the feasibility of the alternative selected.

—Displacement of human body fluids and changes in fluid composition under microgravity.

Working with the German company Dornier and several European doctors, Matra is studying possible concepts for the measurement and monitoring of these physiological processes. The emphasis is on methods that are non-invasive to the astronauts. A ground model will be developed to demonstrate the feasibility of the chosen solution and its suitability for medical objectives.

Rhesus—Animal Physiology

This program is the result of collaboration between the CNES and NASA on the flight of two Rhesus monkeys aboard the American shuttle (IML 2 mission, 1992).

The CNES designated Matra chief contractor for the supplying of the two modules installed in a double rack of the Spacelab and serving as the animals' immediate environment.

Matra is working with the Carrar Company and the Soterem Company to develop the sub-systems attached to the modules.

The two monkeys will embarked in compartments similar to those developed during the preliminary phase at CERMA [Committee for Ocean Research and Equipment].

The monkeys' physiology and their physiological changes created by the microgravity environment during flight will be studied during several consecutive missions; systems include:

—cardiovascular,—neurosensory,—muscular and bone, etc.

Extrapolation from some of these systems to the astronauts' human physiology and physiological monitoring will be studied.

The modules are equipped with the essential life-support sub-systems necessary for the monkeys:

—waste collection—urine collection—food and drink distributor—restraining seat—device to monitor and control the atmosphere and environment

These devices function wholly autonomously during flight and are compatible with the three essential requirements of missions:

—safety of the shuttle and its crew—safety of the animals—accomplishment of scientific objectives, requiring in particular sample collection and data storage.

Biorack

The Biorack project is part of the European Space Agency's microgravity program. Its goal is to study the effects of microgravity and radiation on living species such as plants, tissues, cells, bacteria and insects. The facility includes life-support systems plus devices to manipulate, preserve and examine specimens.

The life-support systems consist of two incubators whose temperatures can be preset within a range extending from 18 to 40 degrees C and a refrigerator-freezer whose temperatures are set at +4 degrees C and -15 degrees C respectively. The incubators are equipped with two centrifuges which can apply acceleration of 1g to the control containers installed there. All the parts are assembled in a plain rack in Spacelab, with the rack itself mounted aboard the American shuttle.

To offset the lack of electricity during launch and homebound phases, the specimens are placed into thermos compartments that provide the required temperature by using materials whose phase changes occur at just those temperatures.

The biological samples to be studied are themselves placed in experimental containers of two standard kinds in terms of interface with the outside. Arrangement of the inside is the responsibility of the user.

Space Bio-Separation SBS

SBS is a 6-year Eureka project with a budget of over 180 million French francs.

Its objective is the fabrication of a purification instrument for use in space able to produce biological materials of very great purity—medicines for instance—and to validate techniques developed in the earth environment.

Collaborators are divided among three countries in Europe, as follows:

FRANCE	MATRA ESPACE	Chief Contractor, Coordination
	CNES	Scientific aspects, Specimens Placed on-board
	ROUSSEL-UCLAF	Biological aspects
SPAIN	CRISA	Electronic and thermal equipment
	ESCLAT	Fluid equipment
BELGIUM	AMOS	Mechanical equipment
	EUROGENTEC	Biological aspects, GROUND
	IAL	Integration of models

The project will proceed in four consecutive phases:

—technological validation of a phase separator through a flight in a recoverable photon capsule in April 1989. SEPHA experiment;—SBS 1, an instrument validating the principle of continuous-flow zone electrophoresis, flight planned for 1992. RAMSES or SELECTE experiment;—SBS 2, improvement of SBS 1, flight in 1993;—SBS 3, fully automated purification system, flight in 1994.

HOLIDDO

Interferometric Holography from Two Observational Directions

Holiddo is an instrument designed to study transparent objects in microgravity. It is a holographic bench that can be used to analyze transitory phenomena that result in changes in the medium's optical indices over time. It is intended for use in many types of experiments that could benefit from a reduced-gravity environment, such as:

—separation processes;—the study of nucleation kinetics;—the study of crystal growth from transparent solutions;—diffusion processes;—the study of stresses;—the study of solidification in transparent materials;—the study of critical point;—others.

Holographic Interferometry

Holographic interferometry consists of bringing into interference two holograms emanating from the same object but shot in different states. This gives a three-dimensional image of the object (hologram) on which are superimposed interference bands reflecting the variations in the object's optical index between those two states. This interference image makes it possible to qualitatively and quantitatively analyze in real time very slight transformations in the object that have an influence on its optical index, such as, for example, the temperature and concentration of a transparent solution. The interference bands resulting from modifications in the object during the experiment are then followed with a high-resolution CCD [charge coupled device] camera located behind the transparent holographic base. If the number of bands created during the experiment becomes too great, another baseline hologram is then recorded.

Basic Concept

HOLIDDO is a multi-user instrument in which scientific experiments are conducted in an individual, portable experimental cell that applies the different stimuli (thermal, injection, agitation, etc.), measures invasiveness (thermocouples, sensor, etc.), and carries out the different mechanical movements associated with the sample.

The transparent sample is visualized in real time from two directions using holographic interferometry, chemical optics and, eventually, the recording of simple holograms.

The possibility of observing the sample using holographic interferometry of different wave lengths in order to separate the effects of temperature and concentration on the variation of the medium's observed optical index is being considered.

Contact-Free Treatment Equipment

The laboratory for gas-film treatment of materials without bringing them into contact with the crucible is one of the future materials-science labs of the Columbus system's pressurized module.

The value of contact-free treatment is that it eliminates all pollution of the sample by the crucible and frees one, for solification experiments, from the heterogeneous nucleation threshold.

This technique to levitate liquid or solid samples using gas films is based on know-how gained by the Solidification Studies Laboratory of the Grenoble Nuclear Studies Center; in it, a pressurized gas, forced through a porous drain wall between the drain and the sample, forms a thin film which separates the load from the wall. Stable positioning conditions, independent of the system's temperature and the nature of the carrier gas, are maintained by regulating pressure differences. This can mean either the pressure difference between the sides of the porous walls or the pressure difference between the sample treatment chamber and an adjacent pressure chamber with porous walls that act as the sample's crucible.

Levitation, crucible, and pressure and treatment chambers are all incorporated into a resistance furnace for treating materials.

This piece of equipment can treat any material compatible with the maximum temperature of the system, but especially non-metallic materials such as glasses.

Scientific Experiments on a Chinese Capsule; 5-11 August 1987 Flight

An experimental module placed on board with its energy source on the recoverable Chinese capsule - First Western scientific mission aboard that satellite.

This mission involving two microgravity experiments developed by Matra had a dual objective:

—technological, with the installation of a compartment for three-dimensional microaccelerometer measurements capable of monitoring microvibrations in the capsule;—scientific, with the installation of a compartment for simulating a closed microecological system.

Experimental module placed aboard: The microaccelerometer compartment contains four cards controlling the commmand, collection, and monitoring electronics as well as memorization of results on EPROM (expansion unknown).

The ecological compartment consists of juxtaposed tubes containing photosynthetic algae and cells enclosing oxygen-consuming cells. Results are deduced by observing the state of the species culture after flight.

Analysis of findings showed that the mission was a complete success:

—the microaccelerometers were validated and their functioning provided proof that the sensors are able to track the microvibrations of the satellite, on the order of 10 within the range set for the experiment.

—Ecological microsystems were validated in principle by the observed growth of the photosynthetic algae and the survival of the species placed on board.

New projects have come out of the results of this flight:

—the construction of a compact three-dimensional microaccelerometer case placed aboard the Olympus satellite;

—the creation of a European program to study the stability of closed ecological systems based on algae culture.

Telescience

For Columbus's orbital infrastructure to be used effectively, experimenters must have the means to directly carry out their experiments from their own laboratories. Indeed, the experience of current flights shows that the crew's workload does not allow them to provide constant backup for the operation of payloads; moreover, use of the automated laboratory must be possible in the absence of a crew. Finally, increased efficiency and new kinds of experiments make it necessary for investigators to have real-time control of operations underway and the capability of immediately analyzing results. This effectively makes it possible to conduct experiments on the basis of already obtained results, with a short reaction loop. These demands led to the definition of a new operational concept: Telescience, which will enable investigators to function interactively with their payloads, to analyze results in real time, and to cooperate with the crew when necessary, while satisfying Columbus's very strict safety requirements.

In order to specify system requirements (both for the ground portion and on-board systems) and to define operational scenarios, Matra developed a Telescience Test Bed to carry out an evaluation program.

The first version of this Test Bed can conduct two experiments (human physiology with ergonometric bicycle and botany with vegetable growth) from an

investigator work station through a high-level man-machine interface. From his station, the experimenter can set experimental conditions for transmission times (up to 4 seconds; separately for audio, video, remote control and remote sensing), the probability of errors on the CCSDS (expansion unknown) link-up, and transmission-channel capacity.

Telescience: Use of Columbus

All scientific experiments planned require some interaction on the part of the scientific experimenter. This can be done in space by an astronaut specialist, as in the case of the Spacelab or the Columbus Attached Laboratory. Direct access to the experiment from the ground, however, would save astronaut time while increasing the frequency and effectiveness of these interactions.

In the Free Flyer program, it is becoming absolutely necessary to act directly from the ground through Columbus's communication system (remote control, remote sensing, video, etc.) during non-visit phases. Moreover, automatic action and on-board robots will allow physical movements to be remotely controlled.

The concept of telescience thus aims to bring space experiments closer in line with experiments in earth laboratories. Its primary function is to allow the experimenter to scientifically diagnose the progress of his experiment and, if necessary, modify the parameters. This requirement prompts the design of a telescience network for Columbus.

The network links, via the communications system:

—on-board payloads, equipped with reporting devices to monitor the experiment, easily reprogramable by remote-control and reconfigurable from the ground if necessary;—robot devices able to perform the necessary movements for positioning, loading, and service;—a ground user-interface, located in a center named USOC, that displays data to the scientist and systems engineer in charge and sends commands in quasi-real time for control of the experiment.

Matra has built a device (Telescience test bed) to evaluate the concept of telescience for the European Space Agency. The environment includes:

—two experiments, one physiological (tràining bike with cardiovascular and ergonometric measurements), the other botanical (observation of plant growth under microgravity using an inspection device moved by a robot arm);—a data-exchange simulator, with delay, video compression, and introduction of errors, to evaluate communication problems;—a work station that allows dialog with the experimentor through a graphic man-machine interface, and control of the test bed.

Matra incorporated this device into ESTEC (expansion unknown) in March of 1989, in a Columbus mock-up that also includes the Data-Processing System test bed (DMS test bed).

The CNES is preparing a pilot project for which Matra will be the industrial architect. A preliminary phase to assess the value of the different participants was just completed in March of 1989. The program, christened BAROCO (for Columbus Robotized Structure), includes a systems' definition phase, followed by the construction of a ground mock-up. This experimental model will be equipped with robot devices developed by the AEC, a Free Flyer data-exchange simulator, and its associated communications network. Using an USOC (expansion unknown) prototype in Toulouse, scientist-users can be shown the possibilities for conducting Columbus experiments from the ground. Validation flights are also planned.

The experimenter maintains precise control over the collection process—definition of the parameters to be collected, frequency of collection or sub-sampling—and has data-storage capability. From the same station, he controls experiments through a graphic interface, menus, and a mouse, and runs the remote handling equipment and the color video system (digitalization and compression.)

Ways of constructing repetitive collection commands and of executing sets of time-tagged commands are available. Experimental findings are displayed on the graphic screen or a plotter.

France-Spain Joint Venture in Space Technology

90CW0045b Paris AFP SCIENCES in French
26 Oct 89 pp 17-18

[Article: "'Iberespacio,' a New Mixed French-Spanish Company Specializing in Space Technologies"]

[Text] SNECMA's subsidiary announced 20 October in Paris that the European Propellent Company (SEP) has just created, with a group of Spanish firms, a joint subsidiary that will be devoted to research in aerospace high technology, particularly propulsion.

The 50/50 subsidiary, christened Iberespacio and just formed in Madrid, comprises on the Spanish side the engineering group Empresarios Agrupados, made up of three companies: EPTISA (Estudios y Projectos Tecnicos Industriales), GHESA (Gibbs y Hillos Espagnola SA) and TRSA (Tecnicas Reunidas SA).

Iberespacio will offer its services on the European and international markets in strategic market niches related to launcher, satellite, and orbital-platform propulsion and other space projects. SEP spokespeople stress that a certain number of contracts are under study with the European Space Agency (ESA).

The company will be managed by two Spaniards, Adolfo Garcia Rodriguez and Juan Francisco Nebrera, who will assume the duties of general administrator and general director respectively, and by a Frenchman, Philippe Frechon, named technical director.

Dassault Building Space Center for Hermes

90AN0059 Paris LA LETTRE HEBDOMADAIRE DU GIFAS in English No 1496-2, 26 Oct 89 pp 1-2

[Article: "Creation of the Dassault Space Center"]

[Text] The Dassault Company has recently created the Dassault Space Center at Toulouse-Blagnac for furthering its space activities. The first task will be to tackle the ambitious challenge of designing and building the Hermes space shuttle and putting it into flight order. The important 3-way program Ariane 5-Hermes-Colombus was voted in 1987 at the Hague Conference of European Ministers. This project is being supervised by the European Space Agency, which has commissioned the National Center for Space Research (CNES) with overseeing the building of the spacecraft. CNES, in turn, has appointed Aerospatiale to act as delegate prime contractor in aeronautical matters and Dassault to be responsible for: aerodynamic conception and aircraft shapes; re-entry flight paths and aerothermics; general structural conception and the associated testing; design and supply of thermal protection; flight quality and building of the piloting system for atmospheric phase; and subsonic flight testing. A special integrated team at Toulouse-Blagnac includes engineers from Aerospatiale, Dassault and Deutsche Hermes. The team works in close collaboration. Later, the Dassault Space Center will be involved in other space activities of the firm, such as future reusable space transportation vehicles (Star-H).

Olympus-1 Satellite Begins Operations

90AN0050 Chichester INTERNATIONAL TELECOMMUNICATIONS INTELLIGENCE in English 6 Nov 89 p 1

[Text] The Olympus 1 communications satellite, built by an international team led by British Aerospace (Space Systems) Ltd, has become operational after a series of rigorous post-launch commissioning tests. Launched from French Guyana in mid-July by the French Ariane rocket, it has been thoroughly tested by the European Space Agency in Belgium.

The satellite has performed to specification in all respects, according to British Aerospace.

One of the first broadcasting organisations to use the satellite will be BBC Enterprises, who will use part of the spacecraft's high-power DBS payload to broadcast a range of programmes—a service to be known as the "Enterprise Channel." This will offer BBC programmes, with emphasis on current affairs shows that contain a strong European slant. The BBC plans to experiment with simultaneous multilingual dubbing of sound.

One transponder of the DBS payload has been allocated to Italy, to be used exclusively by the Italian national television company RAI-TV for a pre-operational service. This beam will be the most powerful DBS beam in the world, and viewers will be able to use receiving dishes as small as 30 cms in diameter.

Eurostep, a new association of educational institutions, expects to commence DBS test transmissions this month.

British Telecom International will use DBS payload capacity for "narrowcasting"—one way, point-to-multipoint data transmissions for a variety of experimental applications.

British Aerospace will use Olympus for video conferencing experiments, linking its sites in Stevenage, Bristol and Plymouth, using the 20-30 GHz communications payload.

BIOTECHNOLOGY

French Firm Develops Fast MCA Production Process

89AN0336 Brussels INDUSTRIE in French Sep 89 p 73

[Article by F. Menozzi: "Accelerated Antibody Production"]

[Excerpts] A French company has developed a new technology that substantially speeds up (a few days instead of 6 months) the process of obtaining cells producing monoclonal antibodies (MCA).

The entire procedure, from the immunization of the animal to the selection of the particular hybridoma, can take 6 months or more. A new method developed by the French company Bioinvest now makes it possible to obtain, in 5 days, antibody-producing cells directed against a given epitope. With this technique, immunization no longer occurs *in vivo* but *in vitro*. This has two advantages: The quantity of antigen required for *in vitro* immunization (10 micrograms) is 10-50 times smaller than that required for the immunization of a mouse; and, above all, this method is less costly than the *in vivo* method, because the cost of maintaining animals is eliminated.

The principle of this method is demonstrated in Figure 1; it is based on the activation of B lymphocyte cells from mice by the selected antigen. This activation occurs in a novel medium composed of lymphokines derived from T lymphocyte cells and from a line of murine thymoma cells. The lymphokines are protein factors that are synthesized by the immune system cells and which regulate its functioning.

After the B lymphocyte cells are activated, they are combined with cancer cells to render them "immortal," and the hybridomas are then screened, just as in the *in vivo* immunization technique, to isolate the hybridomas

producing MCAs of interest to the researcher. Until now, this *in vivo* immunization technique, dubbed Virotech, has been successfully tested with more than 40 different antigens—peptides, proteins, nucleic acids, glycoproteins, bacterial lipopolysaccharides, etc. The results obtained show that the MCAs generated are in every respect identical to those obtained by *in vivo* immunization (same affinity, same specificity, same facility for growing secreting hybridomas, etc.). The MCA subclasses obtained by this method are, as in the conventional method, immunoglobulin Gs and IgMs. The sensitivity of the *in vitro* immunization technique is very high, as demonstrated by the fact that in the production of MCAs against myoglobin (muscular protein), 1 nanogram of antigen was sufficient.

In Vitro Immunization

IMMUNISATION IN VITRO
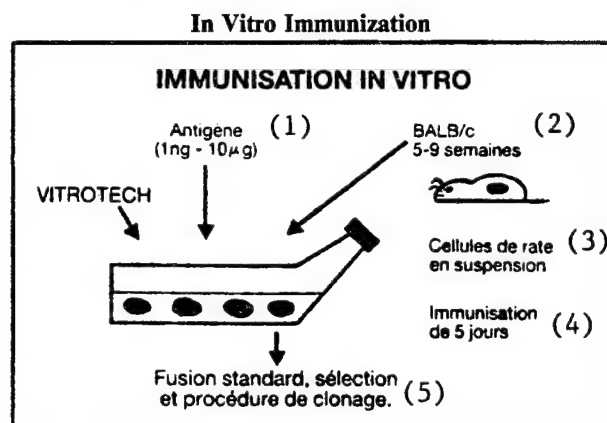
Principle of *in vitro* immunization by the Vitrotech method. Splenic cells from 5- to 9-week-old BALB/c mice are placed in suspension in a Roux box (sterile culture flask) with a surface of 75 cm² and containing B lymphocyte cells as the stimulation medium. The antigen is then added, its concentration varying from 1 nanogram to 10 micrograms per milliliter, depending the type of antigen. After 5 days of incubation at 37 degrees Celsius, B lymphocyte cells secreting antibodies against the added antigen appear. These activated B lymphocyte cells can then be combined with the cancer cells. The immortal hybridomas thus obtained are cloned and characterized to identify hybridomas of interest, i.e., those that produce MCAs directed against the desired epitope(s) and those that produce them in quantity.

Key:—1. Antigen (1 nanogram to 10 micrograms)—2. 5- to 9-week-old BALB/c mice—3. Female rat cells in suspension—4. 5-day immunization—5. Standard combination, selection and cloning procedure

COMPUTERS

INRIA Participation in ESPRIT II Projects

90AN0357 Le Chesnay INRIA INFORMATION in French Aug 89 pp 3-5

[Text]

GIPE II

The GIPE II (Generation of Interactive Programming Environments) project plans to use a generic interactive environment as the basis for two-way developments:

(1) research in the field of interactive environments based on stated specifications; and (2) design, implementation, and experimentation on life-size environments for industrial applications.

The basis for the project is the interactive-environment generator developed as part of ESPRIT Project 348 (GIPE). That system is based on the full, formal description of a programming language and produces a specific environment for that language. The environment produced includes an editor, an interpreter/debugger, and other tools, all of which have a homogenous, graphic interface. The GIPE I project showed that this technology is available. GIPE II aims to render that technology operational by facilitating the development of large-scale formal definitions, increasing the operational capabilities and performance of the environments developed by the system, and highlighting the characteristics of this method using a limited number of well-chosen industrial applications.

ICARUS

ICARUS is an acronym for Incremental Construction and Analysis of Requirement Specifications. The project aims to develop formal methods and software tools to build and reutilize requirement specifications.

Briefly, the analysis of requirements is the engineering activity that seeks to inventory, organize, and express the requirements of a consumer (giver of instructions). In the ICARUS context, this definition is to be understood in a relative sense as applying to the development of a software project. It is important not to confuse the specification of requirements (which describes the operational properties and the constraints of the data-processing system and environment in question) with the specification of the software relating to the work of the developer. To perfect the specification of requirements, ICARUS distinguishes three complementary design levels:

(1) The specification itself, i.e., the description of the requirements (the "what").

(2) The specification process, which appears as an organized group of activities (choices, decisions, transformations, etc.) facilitating development of the specification (the "how").

(3) The reasons for the development choices that justify the activities (the "why").

Project development will center around the following activities:

• Study of numerous actual cases, with major assistance from industrial partners.

- Definition of a framework and formal languages to model and express the project level, process level, and rational or reasoning level. This formalization must in no way restrict the liberty of the specifier but rather must provide a framework enabling him to rationalize the specification he is developing.

- In the second year of the project, development of software tools for integration into a prototype to manage the three previously mentioned design levels. The desired software environment will rely upon the process development concept and will provide active assistance to the specifier: various checks, product and process visualization, generation of prototypes, etc. This development will seek to utilize as much as possible existing tools, e.g., PCTE, PACT, GIPE, and GRASPIN.

The participation of the PROCYON project, directed by JP Finance, will equal 17 man-years. That participation concerns the central task, which is to develop specifications for a normal framework and a linguistic framework to express the three levels indicated above while taking into account possible temporal constraints. PROCYON is also involved in the design of the environment, the development of specialized tools, and, to a lesser extent, case studies.

STRETCH

The purpose of the STRETCH (Extensible KBMS [Knowledge-Based Management System] for large knowledge-based applications) [in English as published] project is the integration of database and knowledge-based technology. The aim of the project is the development of a system that can manipulate large volumes of information, draw inferences from stored data by using logic programs, and express the semantic structure of data in an object-oriented style.

Two major directions are planned: The first is the development of an expandable object server. This server will support access to and concurrent and reliable updating of large bases of complex objects (lists, trees, graphs, etc.) as well as the carrying out of specific operations on these objects. These operational capabilities are offered in "primitive" form and will serve as the basis for the expandability of the system. The second direction is the development of two languages for writing applications—one will be based on production rules and the other will be a persistent object-oriented language. Each language will have an optimizer-compiler interfacing with the object server. The task of the National Institute for Research in Information Science and Automation (INRIA) will be to design and develop a large part of the object server and of the rule language and its optimizer-compiler. It will be a followup to the work of the ESPRIT I ISIDE project.

ARMS

The ARMS (Advanced Robotics Manipulator System) project plans to tackle the mass of problems related to assembly robotics. The project's major areas extend to:

- Mechanical structures: composite materials, motorization (KUKA, CEA [Atomic Energy Commission]);
- The control unit: hardware and software architecture (Telemecanique, INRIA, CEA);
- Off-line programming: integration into the ROBCAD system of planning functions (Tecnomatrix, CRIF [Technical and Scientific Research Center for the Industry of Metal products], INRIA);
- Implementation of the entire system devloped in the framework of two final assembly applications—one in the automobile indusry (Citroen), the other in the home electrical appliance field (Zanussi).

The prime contractor is Citroen Industrie. The project will last 3 years and has a total budget of ECU 10 million, 50 percent of which will come from the EC.

In this projec INRIA will work on the following tasks:

Verify:

- Control aspects (choice of approach, definition of algorithms);
- Controller specification;
- Design and operating tools (programming, simulation, calibration).

Offline Programming:

- Database (specification of geometric data structures);
- Planner (geometric reasoning, trajectory generation and planning).

The INRIA budget is ECU 598.6 billion and represents a workload of 9 man-years.

ITHACA

The purpose of the ITHACA (Integrated Toolkit for Highly Advanced Computer Applications) project is the creation of an "object-oriented" software environment to serve as support for development and use of integrated applications in the areas of office automation and management and computer-aided design (CAD).

This environment will include:

- An object-oriented language with strict typing, its own compiler, and an interface with a database system allowing object persistence;
- A group of predefined classes constituting a software base for the rapid development of applications. This base will include, in particular, a generic object model and office automation;
- Software engineering tools: class visualisers, editors, dialog managers, etc.;
- An environment supporting the applications: task management and coordination system, cooperative

work support, user assistance, and information system.

Testing of the whole sytem will be carried out at three demonstration sites, selected in the fields of CAD in the chemical industry, corporate financial management, and public administration file management.

INRIA participation relates to the development of user interfaces (interface editor, UIMS) and the design of help system(s) to be offered to the users.

MULTIWORKS

The purpose of MULTIWORKS (Multimedia Integrated Workstation) is to develop a low-cost multimedia office automation workstation. The project has two key areas of endeavor:

A. Hardware

MULTIWORKS is based on a second-generation reduced instruction set chip (RISC) architecture; its purpose is the integration of advanced very large-scale integrated (VLSI) technology. In order to minimize costs and keep them competitive with PC costs, plans are to integrate directly on silicon certain multimedia operational capabilities: A group of multimedia E/S mechanisms must be integrated into the basic hardware platform.

B. Software

The MULTIWORKS machine will be UNIX-compatible with international standards. The purpose of the software architecture is to provide an object-oriented platform for the development of advanced, multimedia document management applications and a hypertext system called "hypermedia." The software will thus have to manage the workstation hardware operational capabilities—OCR, speech, printing facilities, scanner, high-resolution screen, and X-standard-compatible environment network.

Three INRIA research teams are participating in this ESPRIT project.

1. Speech Recognition

Under MULTIWORKS, the purpose of the INRIA-Lorraine SYCO projects is to develop specifications for the software corresponding to the automatic workstation speech recognition operational capability. More specifically, we are concerned with:

- Development of specifications for a high-oral-component multimedia dialog manager for the control of a multimedia editor. This system will integrate structural analyses (syntactic, semantic, and pragmatic) and a task-oriented dialog capable of interpreting elliptical and/or anaphoric statements. In Phase I of the project (2 years) the system will use an artificial language and isolated-word and connected-word techniques; in Phase II (4 years) it will support a more extended sublanguage to include continuous speech.

- Input of oral data: The 4-year goal is to come up with a dictating machine than can handle at least 5,000 forms. In the initial phase, we will integrate average-vocabulary recognition (less than 1,000 words) using methods of the Hidden Markov Models (HMM) type with speaker apprenticeship.

2. Language for Hypermedia Systems

The INRIA-Rocquencourt LANGAGES project plans to develop and then implement a MULTITALK programming language for hypermedia systems, i.e., multimedia document systems integrating text, image, voice, video, graphics, etc., and interconnected by symbolic links allowing nonlinear access to various parts of documents.

MULTITALK will be designed on the basis of Apple's HYPERTALK and the Xerox Notecard system and will operate in the hypermedia document-editor environment proposed by the project's partners, namely BULL, Olivetti, and ICL. The structure of the language will be inspired by the various object-oriented extensions of third- and fifth-generation languages. MULTITALK will be implemented in the X-windows (X11) graphics environment with the help of the SYNTAX and FNC-2 "meta"tools of the "Langages et Traducteurs" project. It will support the IBM and CMU Andrew toolkit as well as the HP and DEC toolkit used in OSF.

3. Idea Management Under Hypermedia

Document preparation does not consist simply of editing text, graphics, and images. A much more essential part is the process of the development of ideas; it precedes and continuously intervenes in the act of editing. A 1980 study by Gould measured the importance of the process; two-thirds of the effort of document preparation is devoted to it. The available tools relate primarily to the editing process, however.

Enabling the user to employ strategies for the generation, organization, evaluation, and control of ideas more suitable than the usual descending approach should therefore contribute to an increase in the productivity of every prospective editor.

The assigned goal is the study and application of such a tool and its integration into the MULTIWORKS hypermedia system.

The planned approach follows the Bisseret proposal for a single tool allowing the user to shift freely from one process (development of ideas or editing) to the other. The final development will be reached only after the following phases: state of art; development and production of a HyperTalk prototype; prototype evaluation; and final redesign.

INRIA Participation in Precompetitive ESPRIT Projects

Title	Partners
IMSE: Integrated Modelling Support Environment	STC, Thomson-CSF, IPK, Simulog, Universities of Edinburgh, Dortmund, Milan, and Turin, IANPavia, SINTEF [Norwegian Foundation of Scientific and Industrial Research], University of Paris V
ICARUS: Incremental Construction and Use of Requirement Specifications	Philips-PRLB, University of Namur, CGE-LDM, SEMA-Group, Alcatel, University of Catalonia, COPS
LOTOSPHERE	University of Twente, SYSECA, LAAS, UPM, British Telecom, CPR, Alcatel, GMD, DcNeher lab, Oce, University of Berlin, University of Stirling, Ascom Hold
GIPE 2	SEMA-Group, Bull-CRG, GIPSI2, CWI, PTL, ADVA/ORGA, Planet
AITRAS*	Cognitech, Laborelec, AI Systems Technatom
MMI2: Multi-Modal Interface for Man-Machine Interaction with a KBS	BIM, CRISS, Mines St-Etienne, Leeds University, ISS, Rutherford Applied Lab
STRETCH: Extensible KBMS for large KB applications	CGE-LDM, SAGEM, Polytechnical School of Milan, University of Hagen, MBP, TXT
MLT: Machine Learning Toolbox	Nixdorf, CGE-LDM, LRI, Inteliso, British Aerospace, Turing Institute, University of Aberdeen, Technical University of Berlin
DELTA 4*	Ferranti, Bull-CRG, LAAS, SEMA Nixdorf, IITB, IMAG, INESC, MARI, University of Newcastle, CNR, UKAEA
VOILA: Variable Object Identification Location and Acquisition	GEC, ELSAG, University of Genoa, Matra, Plessey, Oxford University, Sheffield University
SUN DIAL*: Speech Understanding and Dialogue	Logica, AEG, CNET, SARIN, University of Erlangen, Siemens, CSELT, Cap SESA
ARMS: Advanced Robotics Manipulator System	Citroen, Telemecanique, CEA, Tecnomatix, CRIF, KUKA, Zanussi, UKAEA
ITHACA: Integrated Toolkit for Highly Advanced Computer Applications	Nixdorf, Bull-MTS, LAD, Delphi, Datamont, University of Milan, University of Geneva, TAO, FRT, Cap Sogeti Innovation, E2S, D. Tech. Forschung Inform., Trinity College Dublin, C.M.S.
ARGOSI: Applications-Related Graphics and OSI Standards Integration	CIMSA-SYNTRA, Rutherford Applied Lab, Tecsiel Selenia, GESI, COSI, GMD, HITEC, Fraunhofer Darmstadt, GTS, Laser Scan, University of East Anglia
Multi-lingual Speech I/O Assessment Methodology & Standardisation (SAM)	UCL, Logica, RSRE, UK Ministry of Defense N.P.L., Smiths Industry, JTAS, AEG, CSELT, TNO, ELAB, GRECO com. parlee, University of Bielefeld, CNR, Bordoni University, University of Bochum, Televerket, Royal Institute of Technology
MULTIWORKS: Multimedia Integrated Workstation	Olivetti, Bull-MTS, Acorn, SGS, ICL, Philips, AEG, Chorus, Triumph Adler, Harlequin, GMD, INPG, Telesystemes, Pol. Crete, AG, ORTUS
EWS: EuroWorkStation	Siemens, Bull-CRG, GIPSI2, Chorus, INESC, Fraunhofer AGD, Rutherford Lab, Brunel, ZGDV University, APD
COMANDOS: Construction and Management of Distributed Operational Systems	Bull, Chorus, LGI, Siemens, Nixdorf, Philips, CNET, ARG, INESC, Glasgow University, University of Stuttgart, Olivetti, TCD, ICL, CNR-IEI, FHG/IAO
NANA: Nouvel Algorithms for New Real-Time VLSI Architectures	IMEC, Catholic University of Louvain, INPG, Technical University of Delft
Categorical logica in computer science	Imperial College, Cambridge University, ENS, GMD, Aarhus, Parma, Sussex
Logical Frameworks: design, implementation, and experiment	Universities of Edinburgh, Cambridge, Turin, Paris VII, Manchester, Oxford, Chalmers
Computing by graph transformations (Working Group)	Technical University of Berlin, Free University of Berlin, Pisa, Bordeaux, Bremen, Leiden
CONCUR: theories of Concurrency: unification and extension	University of Amsterdam, CWI, Edinburgh, Oxford, Sussex, SICS
Models, languages, and logics for concurrent distributed systems	Universities of Pisa, Sussex, Aarhus
COMPASS*: Comprehensive Algebraic Approach to System Specification and Development (Working Group)	University of Bremen, Catalonia, Technical University of Berlin, Technical University of Braunschweig, Dortmund, Edinburgh, Geneva, Catholic University of Nijmegen, Orsay, Passau
Algorithm and complexity	University of Utrecht, Saarbruecken, EHESS, CTI-Patras, Berlin, Dublin, Catalonia, Aarhus, Rome, Warwick
BASIC GOODS: Geographic Object-Oriented Database System	La Sapienza University of Rome, IASI-CNR, Algotec, University of Hagen, University of Karlsruhe
Vision systems for a natural human environment	University of Louvain, MRC Cambridge, Oxford, Utrecht, University College of London, Keele University, Ecole Polytechnique, Sheffield University, University of Geneva, Royal Institute of Technology, University of Karlsruhe, University of Bochum

New Olivetti Computer To Be Marketed in West

*90ES0189B Rome LA REPUBBLICA in Italian
20 Oct 89 p 47*

[Article by Franco Papitto: "And Now Olivetti Is Launching the Computer "Platform"]

[Text] Vittorio Cassoni, managing director of the Olivetti group talks about a "turning point in the information science industry." He is referring to a new system developed by the Ivrea company and presented yesterday in Brussels to European dealers, before being unloaded in the United States. It is called Cp486, no longer a personal computer but a Computing Platform. And the latter "is the basis for the development of the most varied applications solutions intended for the final user," as Cassoni explains in the somewhat esoteric language of information scientists. Cassoni says, "The Cp486 can in fact be used, according to its configuration, as a very powerful personal computer, as a network server, as a departmental computer, and as a technical workstation."

People did not fail to ask—in Italian, and in a hall where English served as unchallenged master—about the possible sale of the Cp486 in Eastern European countries. Cassoni replied that the priority market was Western Europe, destined in the coming years to have high rates of expansion in order to catch up on its delay vis a vis the United States. The Cp486 is looking toward another market, the American market, where Olivetti is already firmly established. Cassoni said that while attention will one day be turned to Eastern Europe, "It will be done with full respect for the rules, and with all needed approvals, as has always been done in the past."

The Computing Platform is intended to be a meeting ground between the past and the future. It is a "universal hardware and software platform arising from the convergence of innovative technology and industrial standards, and it constitutes the basis for development of the most varied applications capable of taking advantage of growing hardware power and a very wide supply of software." For Vittorio Cassoni, the Cp486 "brings together Olivetti experience in the sector of personal computers and minicomputers, offering definitive leading technology. This experience in planning and sales makes Olivetti one of the few world suppliers able to present to the market the new concept of the "Computing Platform.""

The Cp486 is a product of broad international cooperation. The managing director of the Olivetti group said, "Our strategic relations with Intel, Microsoft, and Sco, together with the ability of our project group based in California and our participation in the Eisa consortium, has allowed us to make this product available ahead of the most qualified competitors." The new computer was planned in the Olivetti laboratories of Cupertino, in California, and is produced in the Scarmagno plants in Ivrea. It is one of the first systems to make use of the internal architecture defined by the world consortium, Eisa, which comprises nine of the largest constructors of information systems. Olivetti is the only European company which has been present in the consortium ever since its founding. Thanks to the integrated circuits specially planned by Intel, Eisa architecture incorporated in the new computer considerably increases the global performance of the system, doubling the speed of the preceding ISA standard which, with more than 20 million machines installed, is the most widely used standard at the world level.

Luigi Mercurio, in charge of Olivetti Systems and Networks, the group's plant which operates in the information distribution sector and which designed the new Cp486, emphasized the importance of the new system within the context of Olivetti products. Mercurio said, "The Cp486 is added to our line of solutions destined for the most dynamic market, that of high performance systems for departmental information distribution. The Cp486 will be progressively integrated into the Olivetti Open System Architecture (OSA), ensuring our users of the adoption of new technologies and protecting their software investments." The new system will provide total compatibility with MS-DOS, and MS-OS/2, and Unix System V software. In particular, the entire library of software applications already developed for the series 386 personal computers can be immediately used on the Cp486.

LATEX Laser Beam Tested

*90ES0221Z Paris LE QUOTIDIEN DE PARIS
in French 7 Nov 89 p 14*

[Article: "'Death Ray' Tested at Marcoussis"]

[Text] At Marcoussis (Essonne), the DGA (General Delegation for Armaments) has carried out the first test firing of the LATEX (experimental turret-mounted laser) beam.

The world of scientific research, though perhaps not as spectacular or fantastic as depicted in the cinema, is nonetheless very real and forward-looking, as demonstrated by this experiment, which was observed by Mr Yves Sillard, general delegate for armaments.

Begun in 1986, the LATEX system is a precursor of the kind of weaponry we may expect by the start of the next century. It consists of a high-powered laser combined with an ultra-sophisticated aiming system.

The 700-meter test firing demonstrated the ability of the 40-megawatt system to destroy a target—an "irdome" equivalent to a missile warhead—and a metallic (aircraft fuselage) plate located behind it.

French research over the last 15 years has led to the development of powerful lasers, including the 300-kilowatt LEDA-6, thought to have been the most powerful in Europe in the late 1970's. Various targeting and focusing systems have also been developed.

A number of increasingly powerful experimental versions of Project LATEX have been designed. The work has been carried out by ONERA (National Office for Aerospace Studies and Research) and the optical electronics division of the Marcoussis Laboratories of CGE (General Electricity Company), under the overall supervision of the Defense Ministry's Research, Studies and Technology Directorate (DRET). On 1 October CGE became the Laserdot Company, a wholly-owned subsidiary of Unilas, itself a wholly-owned subsidiary of Aerospatiale.

Already manufactured and operational at this time are a 1-kilowatt industrial laser and a 40-kilowatt carbon dioxide laser. The next step will be to test the LATEX system on mobile targets.

Accordingly,the experimental equipment will be moved early next year to the Landes Test Center at Biscarosse to be installed in a testing apparatus built around the center's "rail," a 2,000-meter railway along which targets can be moved at speeds up to 250 meters per second.

Authorization to go on to the final stage of the program—development of a 400-kilowatt laser—is still pending.

The West Germans are also working in the field of lasers, and French officials hope to reach agreement on a joint program with them. But if no agreement is possible, France already has the technical means, according to the DRET, to develop a laser weapon of its own over the next 15 years.

FACTORY AUTOMATION, ROBOTICS

EC Approves 163 BRITE/EURAM Projects

90AN0036 Brussels EUROPE in English 20 Oct 89 p 10

[Article: "Research: European Commission Approves 163 Projects in the Framework of the BRITE/EURAM Programme (Strengthening of the Technological Basis of Industry), for a Total of ECU 188 Million"]

[Text] The European Commission has approved 163 research projects and 60 "feasibility premiums" in the framework of the BRITE/EURAM research programme.

Launched at the beginning of the year, this programme is intended to strengthen the technological basis of European industry, notably in traditional sectors (motorcars, machine tools, construction, textiles, etc.). Here are the details:

Research Projects Approved

The 163 research projects were selected from 645 proposals covering a wide range of technology applied to the manufacturing industry and the sector of advanced materials. Most are projects for applied research, in the broad sense of the term, involving cooperation with at least two enterprises from two different member countries. Eleven projects, most in the field of materials, consist of research of a more fundamental nature and will be essentially carried out by universities.

A total of 1,021 organisations is involved in the selected projects, 56 percent of which are industries, 21 percent research institutes and 23 percent universities. SMEs [small and medium-sized enterprises] make up 20 percent of the participants (fewer than 500 employees); they represent 36 percent of the industrial participants.

The 645 proposals introduced are said to have involved a cost of ECU 1,400 million. For the 163 projects selected, Community intervention will total ECU 188 million. The Community's contribution represents 50 percent of the cost of each project, the other half being contributed by industrial partners. The average cost of each project is ECU 2.2 million. Twenty-one projects have been placed on a reserve list, which could be activated if further means can be found in the budget during the contract negotiation process. Here are a few examples of the projects chosen (the total cost of each falls between ECU 2-3 million:

- A British firm will join with two other companies, one German and one French, to produce biodegradable plastic and to formulate a process for producing this material. This plastic, should, in time, allow the manufacturing of biodegradable containers, e.g. bottles.

- Two German firms, a Dutch enterprise and an Irish research institute, will work jointly on formulating a new type of optical-fiber protective layer based on the structure of the diamond.

- A project involving eight partners—Spanish, German, French and English—plans to develop a high-performance system of cutting and soldering based on the combination of a high-power YAG (Yttrium-Aluminum-Garnet) laser, an optical fiber beam, advanced sensors and robotics technology. Applications of this system in the motorcar industry are planned.

- An Italo-Franco-Portuguese consortium has been created to develop composite materials likely to satisfy the safety requirements of certain marine applications.

Feasibility Premiums

These premiums are intended to aid SMEs to demonstrate the feasibility of a new apparatus, system, process or concept in different sectors of industrial technology and advanced materials. The goal is to help them prove their capacity to potential partners (typically large companies) for future BRITE/EURAM research proposals.

Sixty projects were selected out of 574 proposals and are divided into two categories: those whose goal is to solve a specific technological problem in a particular field, and those related to more general problems which can be found in several different sectors. The total Community contribution in these projects is ECU 1.5 million: Community intervention in each case totals 75 percent of total costs.

LASERS, SENSORS, OPTICS

France's DGA Unveils New Laser Weapon

90AN0079 Paris LE MARCHE DE L'INNOVATION in French 10 Nov 89 p 6

[Text] A 40-kW CO_2 laser and a temperature of 3,500 degrees C on a stationary target at a distance of 700 meters: These data summarize the demonstration of a laser weapon developed by the armed forces equipment authority (DGA) at the Marcoussis Laboratories. It is the first product of the Laser Linked to Experimental Turret (LATEX) program, which was launched in 1984 and which to date has cost about Fr 600 million.

The system, which will be transferred to the Landes Test Center (CEL) in December, consists of:

- a 40-kW CO_2 source developed by the former Industrial Laser Company (CILAS—now part of the Aerospatiale subsidiary Laserdot);
- a sighting turret;
- and a telescope with a 1-meter diameter (focal distance 0.98) with adaptable optics developed by the Measurement Instruments Manufacturing Company (SFIM) (control electronics and sensor integration) and its two subsidiaries Reosc (optics) and MTO (surface treatment).

The efficiency of a laser weapon is measured in terms of energy deposited on the target. To pierce an aeronautical structure, a minimum of 10 kW/cm^2 is required. In the LATEX experiment, half of the initial energy is absorbed by the atmosphere. Thus, the target (a missile radome) receives energy of 20 kW on a surface area of a few square centimeters (a 5-franc coin). The destruction by fusion of the matter occurs in less than 5 seconds. A system of adaptable optics has been designed for this purpose. It compensates for the defocusing of the flare spot on the target (due to atmospheric disturbances). This operation is carried out in real time by decoding the return echo of a specific signal emitted by the laser. A series of microactuators (either 19 or 37) continously adjusts the mirror's flexible surface (a sheet of molybdenum). This type of device (with 19 actuators) is currently being tested at the Saint Michel Observatory in Provence.

Next year, the LATEX system will be tested on moving targets (up to 250 m/s) at the CEL with its automatic aiming and tracking system. Over the long term (10 to 15 years), a tactical laser weapon of about 100 kW (a range of several kilometers) might be developed. The DGA is looking for a partner—the Germans have a similar program—and for a source that is less sensitive to atmospheric disturbances, possibly deuterium fluorine (4 microns).

SCIENCE & TECHNOLOGY POLICY

France: 1990 R&D Budget Proposed

Budget Outlined

90CW0005 Paris AFP SCIENCES in French 28 Sep 89 pp 1-8

[Article: "BCRD 1990: An Industrial Research Support Budget" under section heading "1 - Research Policy and Organization"]

[Text] Paris—Discussing his budget bill at a press conference on 26 September, Mr Hubert Curien, minister of research and technology, stated that the 1990 BCRD [Civil Research and Development Budget] will be increased by 7.1%, up Fr3 billion to a total of Fr45.353 billion, and will support industrial research in particular.

Course of BCRD: 1990 (Initial Budget Bill) vs 1989 - in Millions of Francs																	
	DO			CP			AP			DO + CP			DO + AP		
	1989	1990	%	1989	1990	%	1989	1990	%	1989	1990	%	1989	1990	%
MRT	15,645	16,586	+6.0	7,501	7,558	+0.8	7,554	8,010	+6.0	23,146	24,144	+4.3	23,200	24,596	+6.0
Other ministries	5,324	5,431	+2.0	13,558	13,765	+1.5	13,836	15,326	+10.8	18,882	19,196	+1.7	19,160	20,757	+8.3
Total BCRD	20,969	22,017	+5.0	21,059	21,323	+1.3	21,390	23,336	+9.1	42,028	43,340	+3.1	42,360	45,353	+7.1

Legend: [MRT = Ministry of Research and Technology.]

DO = General operating expenses: Essentially personnel and supplies.

AP = Program authorizations: Ceiling on funding that can be committed for implementation of investments and support of programs.

CP = Appropriations covering annual costs of financing investments and program support funding.

This increase combines a 6% rise—from Fr23,200 billion to Fr24.596 billion—in funding distributed directly by the Research Ministry, and an 8.3% rise in funding distributed by other ministries.

1990 BCRD Appropriations Breakdown by Ministries - in Millions of Francs

Ministry	Appropriation	1990 increase Over 1989
MRT	24,596	+6.0%
Industry	5,541	+9.5%
PTE	8,484	+6.8%
Transportation & Sea	3,134	+15.9%
National Education	1,807	+4.9%
Other ministries	1,791	+3.4%
BCRD (Operating expenses + Program authorizations)	45,353	+7.1%

BCRD Structure

Research spending represents 53% of the total BCRD and will be increased by 5.8% as follows: Operating expenses (essentially personnel pay, allowances and other costs), up 6.1%; support of programs for upgrading laboratory operating facilities, up 6.1%; other capital spending, up 4%.

BCRD For 1990 - in Millions of Francs

	1990 Increase	Total Over 1989
Major programs	16,354	+5.6%
Industrial research	4,964	+19.4%
Government agencies	24,035	+5.8%
Operating expenses	16,344	+6.1%
Program support	4,248	+6.1%
Other program authorizations	3,443	+4.0%
BCRD (Operating expenses + Program authorizations)	45,353	+7.1%

Major projects—space, aeronautics and nuclear—which account for 36% of the budget, will receive a 5.6% boost in spending. Industrial research spending will total 11% of the BCRD and will receive the largest single boost, amounting to approximately 20%.

"My concern," said the minister, "is to avoid debilitating basic research. It must continue to grow. But we must emphasize priorities and press vigorously in the direction of enabling private enterprise—whose outlay on research is still inadequate—to further its activities in this domain.

Industrial Research

Support of industrial research, Mr Curien indicated, will amount to approximately Fr5 billion (Fr4.964 billion to be exact). Of this sum, Fr1.566 billion, up 30%, are to be allocated to the Research and Technology Fund. Most of this sum will be allotted to the industrial sector, mainly through domestic programs in such sectors as the biotechnologies and materials sciences, but also through projects under the European Eureka program, especially those representing "technological leaps."

"The latter approach," said the minister, "is aimed at supporting large-scale investments with a potential for opening up new economic opportunities for our industrialists. Moreover, Fr843 million in the Industry Ministry's budget—up from Fr280 million—will be used to enhance the diffusion of major innovative projects— projects that are the industrial counterpart of "technological leaps"—among the PME's [Small and Medium-Sized Businesses] and PMI's [Small and Medium-Sized Industries]. They will also be used to fund French participation in several European projects such as JESSI (electronic components: Fr240 million) and high-definition television (around Fr170 million)."

On the other hand, the Posts, Telecommunications and Space budget provides funding totaling Fr1.71 billion, versus Fr1.9 billion in 1989, for the electronics sector strictly speaking: "A sort of communicating-vessel effect to help projects of special current interest," Mr Curien commented.

The ANVAR [National Agency for Developmental Support of Research] budget will provide impetus in the amount of Fr845 million, up approximately 10%, to applicative developmental and innovational effort by the PME-PMI sector, with emphasis on the hiring of researchers.

Major Projects

As major projects, Mr Curien cited civil aeronautics programs, for which funding will total Fr2.883 billion, up approximately 17%. These will concern primarily the Airbus 330 and 340 programs and their associated CFM 56-5C2 engine program. The research minister also referred, in this connection, to hypersonic aircraft projects, two of which are under study in Europe: The British Hotol and the German Sanger. The French project will be submitted during the coming year, the minister indicated.

Space funding is channeled essentially through the CNES [National Center for Space Studies] and will be increased from Fr6.453 billion to Fr7.187 billion, up 11%. This will enable the launching of the new earth-observation-satellite program Spot-4, recently decided by the Government, as well as continued development of the Ariane-5 heavy-launcher, Hermes space-plane, and Columbus space-module projects.

On the other hand, in the nuclear realm, the CEA [Atomic Energy Commission] is due for a 4% cutback from Fr6.555 billion to Fr6.284 billion. "The cutback is not a drastic one," said Mr Curie. "It is owing to the fact that the nuclear program has reached a point of maturity." He said that around mid-October, together with

his colleague, Mr Roger Fauroux, minister of industry, he will submit a paper to the Council of Ministers, titled "Redefining the CEA's Mission."

Tax Credit for Research

Use of the research tax-credit provision has risen rapidly, said Mr Curien: Some 7,000 enterprises will be taking advantage of it, for a total of Fr2.6 billion, in 1989. Of the enterprises spending a significant amount on research, 43% receive 64% of the total tax credit, while 11% of the enterprises in this category receive only 7% of the total credit. The enterprises comprising this 11% are, for the most part, large-sized ones.

The Government has recently adopted a measure to further improve the procedure: From now on, calculation of the tax credit will be based not solely on the preceding year's spending but rather on the average spending over the preceding 2 years. This smoothing of the bumps takes more into account the outlays by enterprises, and will provide some Fr600 million of additional aid to "recompense the persistent."

Basic Research

Government Research Agencies: 1990 Appropriations for General Operating Expenses and Program Authorizations - in Millions of Francs

Agency	Appropriations	1990 Increase Over 1989
CNRS	10,331	+6.9%
INRA	2,454	+5.0%
INSERM	1,825	+5.6%
IFREMER (external operations)	829	+4.6%
ORSTOM	796	+5.4%
CIRAD	578	+5.9%
Other EPST's [Public-Sector Science and Technology Enterprises/Agencies] and foundations	752	+5.9%

Turning to the public-sector research organizations, whose share of the budget will total Fr18.354 billion, up 6% over this year's Fr17.304 billion, Mr Curien referred to the need to "modulate" appropriations in accordance with their priorities. In the case of the CNRS [National

Scientific Research Center] (+6%), emphasis is being placed on augmenting support of programs to "upgrade the level of laboratory facilities and boost their competitiveness."

The INRA [National Institute of Agronomic Research] (+5%) will continue concentrating on the biotechnologies and will establish a new department devoted to nutrition, food and food safety. The INSERM [National Institute of Health and Medical Research] (+5.6%) will step up its work on biomedical and public health research, while boosting technology transfers (bioreagents, biological and medical engineering, etc...) to the industrial environment.

The IFREMER [French Research Institute for Exploitation of the Sea] will complete the fitting out of the oceanographic ship of the future, which is to be equipped with the first high-performance multiple-beam sounder. The CIRAD [Office of International Cooperation on Agronomic Research for Development] will develop its data processing facilities, and the La Villette Sciences and Industrial Park will develop its museological facilities. Its budget will be increased from Fr550 million to Fr568 million, and four staff positions are to be created there.

The Pasteur Institutes will devote their funding to specific programs in areas such as malaria and parasitology. AIDS research, as a tributary of basic research and industrial research, will receive a 20% funding increase from Fr150 million to Fr180 million. Furthermore, 30 ITA [Engineer, Technician and Administrator] positions will be assigned, in this connection, to INSERM, CNRS, and the Pasteur Institute.

Funding of the Ministries' research services will be increased by 5%. University research will also receive a 5

boost in their outlays for training.

Ministry of the Environment funding will be increased by 13% and National Meteorology's by 30%. Research in these areas will be devoted, particularly, to climatic stability and the ozone layer. "Everything that has been said in the various symposiums on this topic this year will be taken into account and funded," Mr Curien emphasized.

Jobs in Science

BCRD for 1990: Proposed MRT Job Creations

Enterprises/ Agencies	New Jobs 1990			Staffing 1990		
	Researchers	ITA	Total	Researchers	ITA	Total
CNRS	210[1]	95[2]	305	11,254	15,138	26,392
INSERM	58[1]	30[2]	88	1,939	2,634	4,573
INRA	42[1]	58	100	1,668	6,627	8,295
INRETS	2	2	4	158	233	391
ORSTOM	15[1]	7	22	812	776	1,588
CEMAGREF	4	3	7	89	504	593

INED	0	2	2	60	100	160
Total EPST	331(1)	197	528	15,980	26,012	41,992
	Managerial	Non-Managerial	Total	Managerial	Non-Managerial	Total
IFREMER	10	8	18	560	556	1,116
CIRAD	14	7	21	625	528	1,153
CSI	4	0	4	411	494	905
CNES	35	10	45	1,063	883	1,946
CEA	0	0	0(3)	1,644	4,043	5,687(3)
AFME	0	0	0	73	48	121
Total EPIC	63	25	88	4,376	6,552	10,928
Pasteur-Paris	5	12^2	17	141	579	720(4)
Pasteur Institutes overseas and foreign	2	2	4	44	41	85
Pasteur Lille	1	2	3	7	53	60
Institut Curie	0	3	3	0	93	93
Foundations	8	19	27	192	766	958
Research Administration	0	13	13	170	152	322
Total MRT	402(1)	254(2)	656	20,718	33,482	54,200
Other ministries	30	64	94	1,498	3,698	5,196(5)
Total BCRD	432(1)	318(2)	750	22,216	37,180	59,396(5)

(1) Includes opening of 150 positions as follows, in anticipation of detachments to high-level teaching assignments in educational system: CNRS 120; INSERM 12; INRA 13; and ORSTOM 5.

(2) Includes 30 ITA positions for research on AIDS, as follows: CNRS 15; INSERM 10; Pasteur 5.

(3) See CEA social plan: 35 positions eliminated under "research."

(4) Not including independently-financed "research" staff workers.

(5) Including 40 positions provided by CEPII (Min. of Plan).

(6) [Public-Sector Science and Technology Enterprises/Agencies].

(7) [Industrially- or Commercially-Oriented Public-Sector Enterprises/Agencies]

Citing plans to create 750 ITA jobs in 1990, Mr Curien stressed the need to pursue an "active jobs policy in the sciences" in order to enable the carrying out of the various programs.

To ease the movement of researchers into high-level teaching assignments, plans also call for reserving 150 senior lecturer positions for researchers who agree to take teaching assignments.

"Outlays for training through research will also be stepped up," the minister added, indicating that spending in this area will exceed Fr1 billion next year and will be distributed as follows: Allotments to research, Fr633 million; to CIFRE [Industrial Training-Through-Research Agreement] contracts, Fr230 million; and to agency scholarships, approximately Fr200 million.

As of the start of 1989, 450 additional research grants were created and financed jointly with the Ministry of National Education. Next year, 450 new grants will be added, and 100 will be extended to a third year. Thus, annual grants will total 2,800, up approximately 50% over the current total of 1,900.

The total of CIFRE contracts—"which comprise a large part of the Fr230 million" and which ease the participation of private enterprise in the training of students for industrial research—will increase from 550 to 650 in 1990. In all, 3,450 such subsidies will be distributed in 1990, versus 2,400 in 1989.

"According to the best preliminary estimates at our disposal," said the minister, R&D spending next year could attain a level of 2.38% of our GDP, versus 2.34% in 1989, and reach our target of 3% in 1996-1997." In conclusion he added that the "constant uptrend" of our research budget confirms "the Government's determination to prepare for the future and in particular for the Europe 1992 dateline."

Research Agency CEO Interviewed

90CW0005B Paris LE MONDE in French
23 Sep 89 p 39

[Interview with Henri Guillaume, chief executive officer of ANVAR: "'Our Priorities Must Be Innovation and Technological Development'"; subtitled "Research

Funding for PME's and PMI's"; by Annie Kahn; first paragraph is LE MONDE introduction]

[Text] "The ANVAR [National Agency for Developmental Support of Research] must now aid the small and medium-sized French businesses and industries [PME's and PMI's respectively] to put together joint projects on a European-scale." In the view expressed by Mr Henri Guillaume, secretary general of the Eureka program, and appointed on 8 July to head ANVAR, a top-priority objective must be the putting of the Agency on a European footing.

Addressing the 22 delegates of national agencies for the developmental support of research who had come to Bordeaux from all over the world to attend the 10th congress of such agencies, Mr Henri Guillaume stated on Wednesday 20 September that, more than ever, the technology game is being played on a world-scale.

But while Mr Guillaume intends to maintain the flow of aid to small business, he also plans to take advantage of the 10% budgetary increase he expects to receive (ANVAR's 1989 projected funding will total around Fr1.25 billion) to increase aid to medium-sized business with more than 500 employees and to low- and medium-technology smokestack industries. He tells us why in this interview he has granted us.

LE MONDE: What impact is the currently good economic situation likely to have on the research and development policy of French enterprises?

Henri Guillaume: The economic situation is seemingly flourishing; but our industrial trade deficit is likely to end up at the level of Fr45 billion as of the end of this year. With our sights set on 1993, innovation, technological development and industrial research are more than ever top priorities. The economic situation must not mask the fact that we must still spend considerable sums in these fields.

LE MONDE: What are our principal weaknesses?

Henri Guillaume: French private enterprise finances and lays out a smaller share of our spending on research than does private enterprise not only in the United States, Japan, and Germany, but also in other European countries.

In the high-technology sectors, our spending is comparable to that of our partners. Our big enterprises are within the general pattern. But in the PMI sector, and particularly in the low- and medium-technology-intensive sectors, we are trailing behind the other countries.

LE MONDE: Is our lag purely a financial one?

Henri Guillaume: No. On the whole, our firms are not sufficiently aware as yet of the need for technological innovation. The osmosis between industry and research has taken place more belatedly in our country than in others. Our scientists and researchers are now partisans

of the idea of relations with the economic world. On the part of our industrialists, however, R&D and the scientific function within their enterprises have not been accorded the same importance in France as abroad. In Germany, there are approximately 13 researchers per 1,000 employees. In France, this ratio was 7 per 1,000 in 1986.

The contribution being made to our industrial structure by our innovative medium-sized enterprises—over 500 employees—is insufficient. To balance that structure, these enterprises, with a firm grip on their financial reins, must develop their R&D services. Otherwise, they will have trouble forging such cooperative ventures on a European scale as will become necessary for reasons of market size and sharing of risks. Generally speaking, however, the French PMI's are not sufficiently involved in EEC programs. At this point in time, only 5% of French firms are prepared, have the means, or are sufficiently open to cooperation at a European level: Putting together a European project requires 1 man-year of work within a firm.

The [public-sector] research organizations must also develop a European-level R&D-transfer policy.

LE MONDE: You were professor of innovational engineering at the Ecole Centrale. Just what does this concept cover?

Henri Guillaume: It is ANVAR's reason for being. It covers methods for bringing innovation to fruition. It covers the planning and implementing of developmental research: Market studies, patent disclosures and registrations, drawing up of business plans, researching for business partners. ANVAR's mission is not solely to finance innovation. It also puts enterprises in contact with the most competent and suitable of potential partners.

LE MONDE: Do you think that France's consultative network devoted to technological innovation is sufficiently developed?

Henri Guillaume: Firms exist that specialize in technology transfers, under contract. The level of supplementary funding to be provided to them by ANVAR when they work with the PMI's has been raised to 50%; that is to say that ANVAR finances 50% of the developmental research contracted out to these SRC's [Research Contract Companies] by the PMI's. This represents a budget of Fr120 million. What is needed now is to also enable the laboratories to use these SRC's as channels for the transfer of the results of their research.

A number of organizations have also emerged at the regional level over the past few years—a "sprouting of buds." What is lacking now is the emergence of a network of suitably-qualified experts. All needs are not being covered at present.

LE MONDE: Which needs, for example?

Henri Guillaume: The PMI's need to be helped to identify their technological requirements. A clearly-defined demand must be worked out. Then, this demand must be matched to what the various centers—from the technical junior colleges to the major laboratories, such as that of the CEA [Atomic Energy Commission]—can offer. To date the communication flow has been mainly downstream. In other words, we have been turning to the industrialists to develop the applicative potentials of the research done by the laboratories. This must continue. But we must also start downstream—from the needs of the industrialists—and work our way upstream, towards a matchup between the demand and the supply.

LE MONDE: Would you go so far as to help the major public-sector research centers to define their lines of research with a view to adapting them more closely to the demand you find existent among the enterprises?

Henri Guillaume: No. Intervening in this respect is not our role.

TELECOMMUNICATIONS R&D

Thomson Presents First HDTV Set

90AN0018 Paris LES ECHOS in French Aug 89 p 5

[Text] In late 1990, Thomson will sell, for Fr 30,000, its first television sets resulting from the EUREKA 95 HDTV (high-definition television) program. Presented at the International Broadcasting Exhibition (IFA) in Berlin, the set, which is compatible with all existing standards, weighs 70 kilograms (154 pounds) and has a screen with a diagonal measurement of 90 cm (35.1 inches). The French company, which has opted for the new 16 x 9 screen format, is in the process of investing Fr 400 million in its Videocolor tube factory in Italy and almost $100 million in the United States, all within 18 months.

Initially, the production of these new large tubes will adhere to the current 4 x 3 format. European demand for large sets, although still modest, has doubled this year to 190,000 units. The director of Thomson's tube division hopes to turn a profit from the investment in the 16 x 9 format by 1992. At that point, sales should amount to more than 150,000 sets per year, cutting the cost per set in half.

Next month, the EUREKA 95 directorate, composed of Philips, Thomson, and Bosch, will meet to define the second phase of this project, which has already cost ECU 300 million since 1986. In Berlin, French Minister of Post, Telecommunications, and Space Paul Quiles—with the support of his West German counterpart—announced that member-states will "step up their efforts" between mid-1990 and 1995.

However, it is also true that funding for EUREKA is split 50/50 with industry. Pierre Garcin, head of Thomson Consumer Electronics (TCE), called for up to a 100-percent increase in funding in order "to be able to proceed more quickly."

CHEMICAL ENGINEERING

CSSR Gears Toward Low-Tonnage Chemical Exports

90CW0012 East Berlin AUSSENWIRTSCHAFT in GermanNo 39, 27 Sep 89 p 28

[Article: "Chemical Products: CSSR Gears Toward Low-Tonnage"

[Text] In 1988, chemical **production** in the CSSR increased by 1.9 percent over 1987 (1987: 3; 1988 industry total: 2). Included among the products with above-average increases were phosphorous fertilizers (up 13 percent), chemical fibers (up 3.8 percent) and plastics (up 3.6 percent).

CSSR **exports** of chemical products, fertilizers and rubber increased by 15.6 percent in 1988 to 8.55 billion korunas. Exports to socialist countries increased by 5.2 percent to 4.8 billion korunas and to non-socialist countries by 32.3 percent to 3.75 billion korunas. **Imports** of these products, on the other hand, declined by 1.7 percent in 1988 to 9.05 billion korunas. While imports from socialist countries fell by just under 12 percent to 4.3 billion korunas, deliveries from non-socialist countries increased by 10 percent to 4.72 billion korunas.

Development Trends in the SSR and CSR

In the current eighth five-year plan (1986 to 1990), the chemical industry of the CSSR has geared toward a further reduction in the use of raw materials, while at the same time increasing their processing level. The goal is a substantial increase in the production of low-tonnage chemicals (see also AUSSENWIRTSCHAFT 40/88, p 28).

Within the scope of furthering the economic integration of the CEMA countries, the CSSR is specializing particularly in the development and production of materials for electronics and optoelectronics, certain chemical fibers, special plastics, polymer additives, etc.

In the **SSR**, development in the chemical industry is based primarily on intensification. The transition to economic account keeping in the industrial sector is taking place step by step; two enterprises are currently participating in the complex experiment.

In addition to improving supplies of chemical products to subsidiary branches of industry with suitable variety, sufficient quality and the necessary properties, and to increasing its contribution to the domestic income, the main objectives of the Slovakian chemical industry up to 1990 are to increase its export presence—specifically in terms of low-tonnage and special-purpose chemicals, as well as rubber industry products—to get away from imports of chemical products and raw materials, and to reduce environmental pollution. The processing of crude oil in the SSR will be less during the current five-year plan, with a simultaneous increase the level of utilization, than in previous planning periods.

By 1995, low-tonnage chemical products will increase to 14 percent of overall production in the industrial sector.

On the other hand, the percentage for crude-oil processing will decrease, as will the production of petrochemicals, inorganic basic materials and traditional chemical fibers.

After 1990, the production of additives for polymers will also assume an important role. The CSSR is currently the most important producer within CEMA of such materials, particularly rubber additives.

Another goal is future continued high growth in the production of industrial plastics which by the year 2005 will is expected to make up approximately 20 percent and thus the major portion of special-purpose chemical products manufactured.

In the current five-year plan there are already structural changes in terms of PVC production through the development and introduction of low-tonnage types of PVC and vinyl chloride copolymers, according to our own research results.

After 1990, the production of ordinary plastics will be reduced in favor of special-purpose plastics and construction plastics, particularly thermoplastics-based polymer composites.

A 17-fold increase over the 1990 rate in the production of industrial chemical fibers is planned by the year 2005. This is expected to provide additional opportunities for exports to socialist and capitalist countries. Products on which development effort is being concentrated include polystyrene/polymethyl methacrylate-based optical fibers for information processing, motor vehicle construction, robotics and illumination engineering.

The development of special-purpose inorganic chemicals, including absorbing agents and catalysts, are to be promoted, as is magnesium-based chemistry for use in metallurgy and the rubber industry.

The production of pesticides will also receive increased attention. Available varieties of this product are to be supplemented or replaced by more effective agents after 1990. Pesticides which are bio-organic in origin are currently under development and should be introduced into production during the 10th and 11th five-year plan periods.

In the **CSR**, efforts in the chemical industry are concentrating on further reductions in the consumption of materials and energy and at the same time increasing the percentage of higher-grade petrochemical products. Moreover, the production of some antiquated products will cease, particularly in the area of inorganic chemistry, and the overall product range, which is too broad, will be reduced.

To date, growth in the production of low-tonnage chemicals in the CSR has not been sufficient to meet the increasing demand of the Czechoslovakian economy. As a result, imports of these products increased, primarily from capitalist countries, while at the same time the CSSR had to restrict its exports of them.

The current expansion programs of the chemical enterprises are oriented primarily toward the needs of the domestic market. Their purpose is primarily to replace imports from non-socialist countries and, additionally, to provide long-term supplies to other socialist countries. The research and development projects are oriented primarily toward products which it will later be possible to export to capitalist countries with a high rate of economic return.

In the future, the special configuration of the chemical industry of the CSR is also to include the following: selected medications and diagnostic tools with increasing use of biotechnology, auxiliary agents and additives for polymers (for the rubber industry), organic dyes, a select and increasingly modern variety of pure chemicals and laboratory-grade chemicals (especially for electronics), special plastics and adhesives, herbicides, high-quality motor vehicle tires, and special polymer products for the health field.

Implementation of Important Projects

In Brno, positive results in the restructuring of the chemical industry of the CSSR gave rise to projects for producing pesticides, medicines to fight cancer, and diagnostic tools (to diagnose AIDS and other diseases), as well as pure, special-purpose gases for use in electronics. Current problems include reducing investment funds and foreign currency limits for new construction projects, as well as difficulties involving project preparation and supplies. These problems affect projects in Ustinad, Labem, Ostrava, Semtin (eastern Slovakia) and Brno.

At the end of June 1989, an agreement was concluded between the CSSR foreign trade company Technoexport, the Austrian firm Voest-Alpine and the French company Litwin for the construction of a plant to produce 120,000 metric tons of alpha olefins annually. This plant, intended for the Spolana Neratovice chemical complex, is an important project in the current five-year plan (cost, including purchase of license: 2.8 billion korunas) and an important part of the restructuring effort in the industrial sector. It permits the continued production of ethylene as a raw material for alpha olefins at the chemical plants in Litvinov. The project is expected to have a positive effect on alpha olefin exports. The products manufactured at the plant are to be supplied primarily to the CEMA countries.

COMPUTERS

GDR: First 1 Mbit DRAM Described

[Article by Dr. Jens Knobloch and Andreas Scade of VEB Research Center Microelectronics in Dresden: "The U 61000 Megabit Memory"]

[Text] Perspective

The biggest semiconductor memory with random access (RAM) currently under production is dynamic memory. These RAMs are produced using the dynamic single-transistor memory cells, since all other cell designs, such as static memory cells with four or six transistors, require a significantly larger surface area, which impedes the creation of an equally large static memory at the same level of technology.

The U 61000 dynamic megabit memory (1 Mbit DRAM) is the first circuit in the GDR—and thus the impetus behind the technology—based on n-well CMOS technology in the structural level to 1 micron (CSGT5d). This structural level and the use of four conductor levels (two polysilicon and one each of molybdenum silicide and aluminum) permit a very high packing density, so that the chip can be mounted in small standard packages. The production technology for the megabit memory is characterized in Table 1. On the back cover (top), the production of the memory is presented in three processing stages.

Table 1 CSGT5d Production Technology
- 430 substeps
- 18 photolithographic configurations
- minimum structure grid: 2.5 micron
- oxide thickness of memory unit: 12 nm
- cell size: 3.8 x 9.0 = 34.2 square micron ^{2}
- chip surface: 5.1 x 12.85 = 65.5 square micron ^{2}
- level of integration: 2.3 million components
- a scaling of the chip is in preparation
- effective minimum channel lengths: 1 micron

The U 61000 has a 1048576 x 1 bit configuration and works in fast page mode (FPM). It is primarily intended for use in computer and communications technology and in industrial electronics, and is characterized by the following main properties:

• dynamic read-write random-access memory
• high operating speed and low power dissipation in keeping with Table 2
• TTL and CMOS compatibility of inputs and outputs
• tristate output stages
• supply voltage: 5 V plus or minus 10 percent

- 512 refresh cycles; refresh time: 8 ms
- operating modes: normal and fast page: READ CYCLE; EARLY WRITE CYCLE; READ MODIFY CYCLE
- refresh modes: RAS ONLY REFRESH; CAS BEFORE RAS REFRESH; HIDDEN REFRESH (READ and WRITE)
- operating temperature: 0 degrees C to 70 degrees C

Table 2 Speed and Functional Parameters of the U 61000

	U 61000 DC12	U 61000 DC10
	Basic type	Selection type
RAS access time	120 ns	100 ns
CAS access time	45 ns	35 ns
FPM access time	60 ns	50 ns
Cycle time	220 ns	190 ns
FPM cycle time	70 ns	55 ns
Operating current	max.50mA	max.60mA
Quiescent current		
at CMOS level	max. 1mA	
at TTL level	max. 2mA	

The circuit is housed in an 18-pin DIL plastic package with a 7.62-mm interstice between rows of pins. During the development period, an 18-pin ceramic DIL package could also come into use.

In this case, the type designations are U 61000 CC12 and U 61000 CC10. A package using stacking technology with a lower space requirement is in preparation.

A complete overview of the properties of the U 61000 megabit memory can be found in TGL 45536 (in preparation).

Structure

The element performing the storage function in the dynamic cell is a capacitor. The charge stored there represents information. Besides the capacitor, the memory cell also contains a selector transistor, through which the information can go from the capacitor to the bit line (reading) or in the opposite direction from the bit line to the capacitor (writing). The memory cells are selected by a superelevated potential in the line or word circuit.

The U 61000 works with a planar single-transistor cell, the block diagram, layout, and longitudinal section of which are depicted in Figure 1. For a memory with a higher level of integration (e.g., 4-Mbit DRAMs), new approaches in capacitor production are emerging in order to achieve a memory capacity in the necessary order of magnitude of around 40 fF, by further reducing in cell size. Since information is stored in a capacitor as a charge, it is gradually lost as a result of leakage currents. Thus, the charge must be regenerated in so-called refresh cycles.
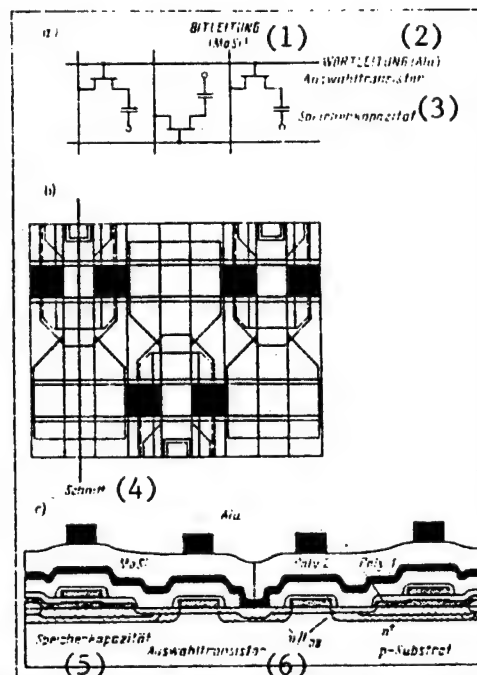
Figure 1. U 61000 Memory Cell; a) Circuitry, b) Layout, c) Longitudinal section

Key:
1. Bit line (MoSi)
2. Word line (Alu); selector transistor
3. Memory capacity
4. Section
5. Memory capacity
6. Selector transistor

The memory cells are arranged on the chip in the form of a matrix. This memory matrix is generally divided into submatrices, the size and arrangement of which represents an optimization of the technological values of resistance and capacitance and of the electrical parameters of delay time and signal identification. By using aluminum, the word line of the 1-Mbit DRAM can be designed relatively long, favoring a short bit line with smaller capacity, thus making for better signal identification. In addition, the matrix structure is characterized by having an internal 4-bit organization as its aim. This configuration was chosen for reasons of power savings, use of a quadruple test mode, and use of the same chip as a memory with the 254 K x 4 configuration. The photograph on the back cover, bottom left, shows the resulting matrix structure in the U 61000.

Activation of the matrix and setting of the clock timing sequences, and the data inputs and outputs are handled by the peripheral circuits that surround the matrix. The corresponding block diagram is shown in Figure 2. The chip is bonded to the circuit board by means of bonding islands (see outsideback cover, top) and circuit pins. Figure 3 shows the pin configuration of the U 61000. Because of the addition of a further address pin (A9) the 16-pin package that is standard for up to 256-kbit
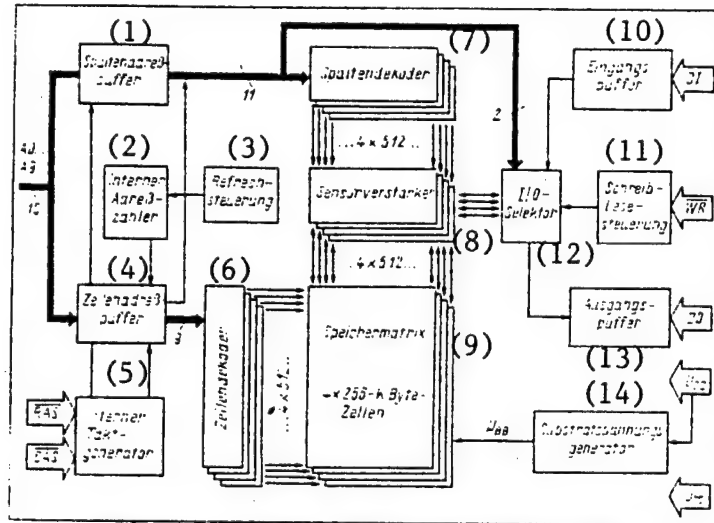
Figure 2. U 61000 1-Mbit DRAM, Block Diagram

Key:
1. Column address buffer
2. Internal address counter
3. Refresh control
4. Row address buffer
5. Internal clock generator
6. Row decoder
7. Column decoder
8. Sensor amplifier
9. Memory matrix, 4 x 256 kbyte cells
10. Input buffer
11. Write-read control
12. I/O selector
13. Output buffer
14. Substrate voltage generator

DRAMs could not be retained. In the 18-pin package, there is a free pin (4) left over that is not connected or that can be used for a special test mode.

Operation

The megabit memory needs a 20-bit address (2^{20} = 1,048,576) in order to select the memory cell. In order to achieve a high integration density using such a memory, small packages are used that preclude having 20 pins for the address. Thus, the address is transmitted to the memory circuit in two halves—the higher-value row address and the lower-value column address—by means of time-division multiplexing, each using 10 address bits. The transmission of these partial addresses is synchronized with the high-low edge of the corresponding RAS (row-address-strobe) and CAS (column-address-strobe) timing strobe. In every memory operation, a word line, determined by row address, is activated in each case, thus causing the interconnected memory cells to relinquish their charges to the respective bit line. In this way, the information is no longer available in the memory cell, e.g., destructive readout. From the bitline displacement, the sensor amplifier recognizes whether a zero or a

one was stored. This information is temporarily stored statically in the sensor register. After conclusion of this first phase, which is controlled by clock pulses derived from the RAS, the megabit memory has 2048 bits available to it in the sensor register, and the corresponding rows in the matrix remain activated for later rewriting.

In the second phase, by decoding the column address, a bit is then selected and output (Read) or modified (Write), or only read and then rewritten (Read Modify Write). The contents of the sensor register are then written back into the activated rows.

One can work with the half (1024 bits) of the sensor register defined by the A9 row address bit, in practically the same manner as with a static memory, operating in the fast page mode.

In the refresh cycle, there is no manipulation of the individual bits, since here only the charge of the memory capacitors altered by leakage currents is restored by internally reading, amplifying, and rewriting two rows at a time. Thus, there is no need to provide a column address in this case.
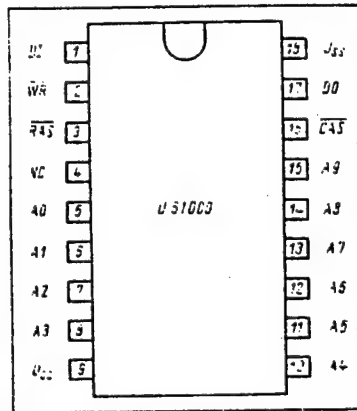
Figure 3. Pin Configuration of the U 61000

A0...A9 ....Address inputs
WR ....Write-read control
DI...Data input
DO ....Data output
RAS..Row address strobe
CAS ....Column address strobe
U_CC...Operating voltage
U_SS...Ground
NC...Not connected

Figure 4 Refresh Techniques in the U 61000; a) RAS only refresh (A9 is ignored), b) CAS before RAS refresh, c) Hidden refresh (read); (shaded areas: level undefined)

Key:
1. Valid data

Refresh

All the rows of the megabit memory must be activated or refreshed once within 8 ms in order for the information in the memory capacitor to not be lost, even under unfavorable conditions (extremes of operating voltage and temperature, production-based tolerances of the leakage currents of individual cells, etc.). To this end, three technologies are available (Figure 4):

- RAS only refresh
- Hidden refresh
- CAS before RAS refresh

RAS only refresh is the standard form of refresh control. The cycle begins (like any other memory cycle) with an active RAS signal edge (high-low), for which the appropriate row address must be ready at the address inputs. The CAS input should remain inactive (high), whereby the output retains its high-impedance state and only a small amount of power is consumed. Since only 512 refresh addresses are necessary, the A9 address signal is ignored.

Inside, the sequence of reading out, amplifying, and rewriting is performed in the row with the designated address. This process must take place at least once within the refresh time of 8 ms in each of the 512 various refresh addresses in order for the information not to be lost. This can be done both in equal time intervals, for example, by refreshing each row after approximately 15 microseconds, and in burst mode, where all rows are refreshed in immediate succession with a subsequent longer phase without refresh. Once it has been ensured that at least one normal memory access takes place in each row

within the period in question, it is possible to entirely forego an additional refresh process. The time needed for refreshing is less than 1.5 percent of the time for normal memory operation.

With hidden refresh and CAS before RAS refresh, the refresh address needed is made available by an address counter internal to the chip. This eliminates the time spent on providing it externally, and the address inputs can assume any values during these types of refresh cycles. The internal address counter is incremented after each access.

With hidden refresh, a refresh cycle can be performed after a preceding read cycle (or write cycle). In order to do so, the CAS signal in the memory remains continuously activated, meaning that the information read remains valid at the output while refresh continues to run in the circuit. Here, after a proper read access, the RAS signal must first be deactivated, and then reactivated. Thus, the hidden refresh runs in the background in an additional memory cycle.

With the CAS before RAS refresh, the internal refresh process is triggered by a suitable combination of the RAS and CAS signals. If the CAS signal at the RAS leading edge is active (low), then the row entered in the internal address counter is refreshed.

In order to test the proper function of the address counter, the data can be accessed in the counter test cycle with the internal refresh address—externally supplemented by the missing row address. This test must be initiated with eight CAS before RAS cycles in order to initialize the address counter. Then, for the first time, for a fixed column address, data are written into every row,

in 512 cycles. These data are then read out again and tested in 512 cycles with identical column addresses. By repeating this test with complementary data, the proper function of the address counter is ensured.

Memory Access

In contrast to refresh, access to a particular address requires the transmission of both halves of the address, thus the row and column address, which must be valid for the active signal edge (high-low) of the respective RAS or CAS strobe signal. Here, the level of the read-write control signal, WR, during the CAS low-edge determines whether it should involve a read or a write cycle. Besides these two most important operational modes, for the various types of 1 Mbit DRAMS, there is a number of type-specific variations which contain a different access organization with a higher operating speed. Besides the fast page mode selected in the U 61000, there can also be a static column mode or a nibble mode.

All the times cited in the following section refer to the U 61000 DC12.

Write Cycle

Figure 5 shows the time diagram of a write access cycle. The write signal, WR, is at low potential during the active CAS signal edge, and at around the same time the information at data input DI must be valid. After execution of the active low phase of RAS and CAS, these signals can again become inactive. Before the next cycle can be started, the memory needs a little time for internal recharging processes (precharge time), which is why the cycle time in dynamic memories is greater than access time. Because in this so-called early-write cycle the data output, DO, retains its high impedance, and in the read cycle described below the information at the data input, DI, can be arbitrary, the two connections can be combined (common I/O). This can be used when connecting the memory to the data bus of a microprocessor system. However, in that case, all the special operating modes of the memory circuit are no longer possible.

Read Cycle

In contrast to the write cycle, during the read cycle (Figure 6), the WRITE signal must remain inactive during the entire CAS low phase. Of particular interest in the read cycle are the access times. Because of the two strobe signals, a distinction must be made between access times of the RAS and the CAS. In addition, even the address access time is effective under certain conditions. These conditions are defined by the spacing between active edges of the RAS and the CAS and by the amount by which the column address leads the active CAS edge. The access time of the RAS, of the CAS, or of the address change is determined depending on selection of these times.

Using the values specified for the U 61000 DC 12:

$t_{RLOVmax} = 120$ ns $t_{CLOVmax} = 45$ ns $t_{SVOVmax} = 60$ ns
$t_{RLCLmin} = 25$ ns $t_{SVCLmin} = 0$ ns $t_{RLSVmin} = 20$ ns

the access times shown in Figure 7 result.

Figure 5. Early Write Cycle (gray areas: level undefined)
Key:
1. Row
2. Column
3. Valid data

Figure 6. Read Cycle (gray areas: level undefined)
Key:
1. Row
2. Column
3. Valid data

Figure 7. Effective Access Times for the U 61000 DC12 Dependent on the RAS-CAS Delay Time t_{RLCL} and the Column Address Lead Time t_{SVCL}

With the transition from the CAS to the inactive state (high), the outputs return to the high-impedance state, while the RAS can become inactive without the outputs of the memory becoming invalid (hidden refresh). The cycle time in the write and read cycle is 220 ns. Lower cycle and access times are achieved with fast page mode.

Read-Modify-Write Cycle

The basic idea of a read-modify-write cycle is to first read and then describe a memory cell in one access. If the new memory content depends on the old content—i.e., if the write information is generated from the read data—then we have a true read-modify-write cycle. How the write data are generated is fully independent of the memory. If WR becomes active immediately after the

access time elapses, then there is no waiting for processing the read data, and the data already available at the DI are written. In this case, we speak of a read-write cycle, which in its basic operation does not differ from the read-modify-write cycle.

The time sequence of a read-modify-write cycle begins as a normal read access, but the write signal, WR, is activated after the access times have elapsed. The information at the memory input, DI, thus passes into the addressed cell. It is clear that in a genuine read-modify-write cycle, it is possible to write only after reading and modifying the read data.

The cycle time of a read-write cycle is 255 ns. In the already described early-write cycle, the memory output remains at high impedance. However, if the active edge of the WR comes after the active CAS edge, but before the access time elapses, it is safe to speak of neither an early-write nor of a read-write cycle, since the output is momentarily undefined and thus no valid read data are guaranteed. However, since error-free writing is ensured, this mode is also called late-write cycle.

Fast Page Mode

Fast page mode permits a higher data rate than normal operation. In this mode, access takes place in a certain area of the memory, specifically, in a 1024-bit page. This is one row of the memory matrix, which is defined by the row address. The advantage of fast page mode is that when successively accessing within one page, the row address has to be transmitted only once, at the beginning, and for each further access only the column address

Figure 8. Fast Page Mode Read Cycle (gray areas: level undefined)

Key:
1. Row
2. Column
3. Valid data

is necessary. Figure 8 shows the read cycles in fast page mode. Write cycles and read-modify-write cycles run accordingly. Fast page mode is triggered by keeping the row address with RAS on low, while a cycle runs with each active CAS edge at the designated column address. Similar realtionships, with regard to access time, hold for read cycles, as described in the section "Read Cycle".

In fast page mode, dynamic power dissipation is less, because internal access of the entire row of the matrix is necessary only at the beginning, while each further access affects only one of the preselected bits. However, it should be noted that a page cannot be activated for an arbitrary period of time. On the one hand, because of internal dynamic processes (floating word line cannot conduct a superelevated potential for an arbitrarily long period of time), the RAS pulse width is limited to 100 microseconds, while on the other hand one may remember the refresh that is needed on a regular basis.

In static column mode, in contrast to fast page mode, a memory cycle inside the "page" is triggered by the change in column address, without need for an active CAS edge. Thus, the memory in this mode functions like a fully static, unclocked memory. Because synchronization with CAS is no longer needed and a CAS precharging time is thus eliminated, the cycle time is reduced in the static column mode.

Because of the great similarity between static column mode and fast page mode, with the U 61000 chip, it is possible to derive both modes from one basic design by changing a masking level.

Power Dissipation

A not insignificant factor in selecting memory circuits is their power dissipation. This should not be understood in the sense of saving energy, but rather because a low power requirement on the part of the memory system means that the cost of the voltage supply (power pack) drops and a network-independent supply system—e.g., with emergency batteries—is simplified or even made possible for the first time.

The power dissipation of dynamic memories is basically determined by three components of current consumption: quiescent current, operating current, and refresh current.

Quiescent current, which is very low because of the CMOS technology used, must always be applied and is used to offset internal leakage currents and to generate internal reference voltages. By applying CMOS levels, particularly to the RAS and the CAS, quiescent current consumption can be reduced significantly compared to the use of TTL levels, which is specified in two different values for quiescent current ($I_{CCR1} = 2$ mA, $I_{CCR2} = 1$ mA).

The operating current is elicited primarily by the current pulses during internal recharging processes, which always occur whenever level changes appear at the RAS

and CAS strobe inputs. The specified current consumption ($I_{CC0} = 50$ mA) applies to the minimum cycle time and decreases, when the memory is operated more slowly, in the ratio of minimum to actual cycle time. If the strobe signals are at low potential for a longer time, then we also speak of active static current consumption, but this is always smaller than dynamic current consumption. In the case of fast page mode, lower operating current consumption is specified ($I_{CC2} = 30$ mA), since only the recharging processes triggered by CAS are running, which do not affect the matrix with its large capacity.

The refresh current is somewhat lower than the operating current, since the output drivers and other peripheral circuits are not activated during refresh. However, the specified value ($I_{CC1} = 50$ mA) does not differ from I_{CC0}. Within the refresh time $t_{Ref} = 8$ ms, 512 refresh cycles are necessary, where the average value of this current component is determined as follows:

$$I_{CCRef} = I_{CC1} \times t_{RLRL}/t_{Ref} \times 512$$

Besides these three current components, the output load current must also be taken into account in principle. However, it can generally be ignored, since I_{CC0} is often significantly greater than the output load current.

Power dissipation results from the sum of these current components, multiplied by the maximum supply voltage, where it makes sense to calculate this value for a concrete memory configuration (printed circuit board, etc.). This means:

$$P_{Vmax} = (I_{CC0} \times j + I_{CCR} \times k + I_{CCRef} \times i) \times U_{CCmax},$$ where i = total number of memory circuits; j = number of active circuits; and, $k = i - j$ = number of inactive circuits.

In the following example, the power dissipation of a memory configuration is calculated. A memory board with an organization of 4 M x 16 bits should be operated with a minimum cycle time. This means the following:

$i = 64$ U 61000 circuits; $j = 16$ U 61000 circuits; and, $k = 48$ U 61000 circuits.

Using the values specified for the U 61000 DC12:

$I_{CC0} = 50$ mA (normal operation); $I_{CCR1} = 2$ mA (activation with TTL levels); $I_{CC1} = 50$ mA; $t_{RLRL} = 220$ ns; $t_{Ref} = 8$ ms

we get three current components

$I_{CC0} \times j = 800$ mA; $I_{CCR} \times k = 96$ mA; and, $I_{CCRef} \times i = 50 \times 512 \times 220 \times 64 / 8 \times 10^6 = 45$ mA

Thus, the maximum total power dissipation for the selected memory configuration is:

$$P_{Vmax} = (800 + 96 + 45) \times 5.5 \text{ mW} = 5.18 \text{ W}$$

Operating Conditions: Operating Voltage, Temperature

The operating voltage for 1-Mbit DRAMs is generally around $U_{CC} = 5$ V plus or minus 10 percent, in a temperature range between 0 and 70 degrees Celsius. However, no memory is so configured that these values can just barely be accommodated, since in that case

production tolerances would immediately lead to defective components. The goal is for the circuits to function at deviations in operating voltage up to more than 20 percent. The main problem for memory is high temperatures, since the self-discharge of the memory capacitors increases exponentially with temperature, which means that the specified refresh time becomes insufficient and data are lost. Besides the power dissipation of the memory system, edge steepness and the peak values of the current pulses are also important in designing the voltage supply. In order to avoid having the operating voltage break down too frequently during current peaks, expedients internal to the circuit must be supplemented by suitable auxiliary capacitors on the printed circuit board.

In this regard, mention may also be made of response during application of the supply voltage. Internal logic provides a specific, gradual switch-on of the functional groups of the memory. In this way, a latch-up during switch-on is effectively prevented, if a proper increase in operating voltage of less than 0.1 V per ns is guaranteed. Another requirement during switch-on is to wait 200 microseconds after achieving U_{CC} and then run eight RAS cycles. This wake-up procedure, ensures that all internal levels are at the proper value and the memory is fully functional.

Input And Output Level

The inputs and outputs of the U 61000 are TTL-compatible. CMOS circuits are easier to drive than TTL circuits, since their levels are in the vicinity of the operating voltage potentials, U_{CC} and U_{SS}. Besides the higher noise immunity, there is also an associated lower quiescent power dissipation.

Control signal edge steepness of 5 ns and less ensures the specified operating speed. However, this is also associated with an overshoot of the input signals. With specific reference to DRAMs, a negative overshoot of -1 V and a positive overshoot of 6.5 V is acceptable. In this context, it may also be mentioned that, in fast or physically extensive memory systems, this can result in disruptive reflections on the data and clock lines.

Soft Errors

One important problem with dynamic memories is so-called soft errors. These are one-time errors that are caused by the effects of alpha particles on the memory capacitor, the bit line, or the read amplifier. These particles come from the radioactive disintegration of uranium, thorium, and other elements that are found in trace quantities in all package material.

When alpha particles pass through the areas noted, charge carrier pairs are generated, and the electron cloud formed in the p-substrate as a minority charge carrier can enter the n-type memory areas and destroy the stored information. Aside from the erroneous data that results, the memory is not damaged. Soft errors are measured in the unit "fit," which indicates how many errors occur in 10^9 hours of operation.

By using low-radiation package materials and implanting a potential barrier under the memory capacitors and bit lines, which renders an electron cloud inert, a low sensitivity to soft errors can be achieved with the U 61000.

GDR: New PC Offered by VEB Messelektronik Berlin

23020002p East Berlin RECHENTECHNIK-DATENVERARBEITUNG in GermanNo 10, 1989 p 2

[Text] The VEB Messelektronik in Berlin is offering a new PC designed primarily for industrial applications. The new device, designated MFA 100 V.16-P, or simply MFA, apart from being applied in the traditional fields, can also be advantageously applied in production sectors, measurement laboratories, and engineering workshops.

The MFA consists of the basic device with a 64 Kbyte storage capacity, an offset floppy disk station (two 5.25-inch disk drives) with a special connecting cable and an external alphanumeric keyboard. The device also includes an electronic diskette, functioning as a third disk drive, making possible accelerated access to programs and data, thus giving rise to high processing speeds. The basic device also incorporates a switchable (German/English) alphanumeric display screen accommodating 24 x 80 characters.

The new device can process MS-DOS formats (360/720 Kbytes) and will use the CP/A SCP upward-compatible operating system offered with the PC 1715. This makes it possible to use all the programs that can be run under SCP. At the same time, the diskette formats of the most wide-ranging manufacturers can be used, up to a maximum capacity of 800 Kbytes.

Additional characteristics of the device include:

—a plus 5 to plus 40 degrees Celsius temperature range for the basic device (plus 10 to plus 35 degrees Celsius for the auxiliary floppy disk station);

—a Class II safety designation;

—robust mechanical construction and containerized configuration requiring only a 19-inch cabinet for its installation;

—reduced HF radiation emission and imperviousness to harmful external radiation;

—eight (8) free slots for adapting hardware to user-specific tasks;

—incorporation of the most widely varying interfaces;

—compatibility with K6313/14 or K6311 printers, using CENTRONICS or IFSS interfaces.

The new device is particularly suitable for:

—organization, control and management of production processes;

—quality assurance through automatic error detection in production;

—inspection, management and control in materiel and technical security;

—detection, analysis and listing of measurement and test resluts;

—mathematical calculations and analysis of statistical data, and

—the execution of partial tasks in complex CAD/CAM applications.

LASERS, SENSORS, OPTICS

GDR: Sensors for Automation Technology

90CW0014 East Berlin FEINGERAETETECHNIK in German No 9 Sep 89 pp 411-415

[Article by C. Seifert of the VEB Plauener Gardine: "Sensors for Automation Technology. Part 1: Sensors for Measuring Temperature and Magnetic Parameters"]

[Text] Scarcely any other concept in modern information processing has generated as much interest in recent years as that of the sensor. The frequency of its use stands in marked contrast to the widespread uncertainty as to its exact meaning. The reason for this is the lack of a generally accepted definition. The following questions arise: Is the English word "sensor" simply a synonym for the well-known detecting element of classic metrology? Should its use remain restricted to primary test-value transducers that can be manufactured on the basis of semiconductor technologies? Is it reasonable to use the term "sensor" as an overall term for all transducers?

Indisputable is the fact that the sensor represents the first link, in a chain of information, which converts any form of energy (radiant, mechanical, thermal, magnetic and chemical energy) into an electrical output signal. The first basic delimitation of the term to detecting element in general is thus provided. Limiting its use to detecting element with electrical output signals seems sensible in view of the further information processing involved.

In this way a non-electrical input signal can be superimposed upon an electrical output signal that is analog or digital, a frequency or binary. On the other hand, restricting the term sensor to a component manufactured on the basis of semiconductor technology is not practical from the point of view of the user. After numerous attempts at a definition, the following quote most closely conveys the meaning as encountered in practice:

"Sensors refers to components or electronic circuit elements which convert non-electrical physical or chemical parameters into electrical signals in order to permit an analysis of the data. They are coupled directly to the environment." The term sensor can thus be used as an overall term for the conventional detecting element with electrical output signals, for sensors manufactured using semiconductor technology and for sensors based on other technologies (as described below).

It is possible to classify sensors from various points of view. Examples of classification criteria are as follows:

- physical operating principles - quantities to be measured - manufacturing technology

Classification as described below is based primarily on the type of quantity measured, although there is some overlap in Section 3, Optoelectronic Sensors, which cannot be avoided, since optoelectronic sensors can be used to measure both optical parameters and other parameters which can be detected based on optical principles.

Sensors may be more or less ideal in terms of the properties they possess regarding measurement techniques and economics, and thus they exhibit realistic behavior. The requirements of an ideal sensor can be defined as follows:

- insensitive with regard to measured values - insensitivity to interference - linearity of the transfer characteristic - good reproducibility of measured values - good dynamic response - small size - possibility of industrial mass production - low production cost - low prices - high reliability - long service life - compatibility with microprocessors

The purpose of this article is to provide the efficiency engineer with an overview of some of the families of sensors commercially available in the GDR. At the same time, emphasis is given to testimony of the manufacturers. More detailed information and extensive secondary references can be found in [4] and [5].

1. Temperature Sensors

Temperature is one of the most important measured parameters in all of industry. A large number of technical processes can viewed as functions of temperature. It is possible to measure temperature by taking advantage of various physical effects. Some examples of these effects are as follows:

- the Seebeck effect (thermocouples) - the pyroelectric effect (pyrometers) - the dependence of temperature on resistance (resistance thermometers, thermistors) - the dependence of temperature on junctions - the effect of light propagation in optical fibers - thermal expansion of solid bodies (bimetallic thermometers, liquid expansion thermometers, etc.)

Temperatures can be measured with or without contact between the sensor and the test object. The advantage of non-contact methods using the radiant properties of objects is that the sensor has no effect on the process

being tested. The disadvantage is that the emission levels of the test object must be known.

Some of the sensor groups of basic interest for industrial and laboratory measurements are described below.

1.1 Temperature-Dependent Resistors

The specific resistance ρ of an electrical conductor depends on the absolute temperature T of the conductor. As the temperature of the conductor increases, so does its specific resistance. At the same time, $\rho = f(T)$ is a non-linear function. The functional interrelationship depends on the material. A measure for determining the temperature dependence of a conductor is its temperature coefficient. Platinum (Pt) is used almost exclusively in the construction of conventional precision resistors, since it ensures good reproducibility of the measured values. Precision resistors made of platinum are manufactured in various geometric shapes by the VEB Thermometerwerk Geraberg (Fig. 1). At 0°C, the resistance is generally set to 100 Ω. Precision resistors consist of a ceramic core onto which Pt wire is wound. A glaze provides an external seal for the coil. In order to protect the precision resistor against mechanical and chemical loads, it is frequently placed in a protective tube with a stopper for in-factory use.
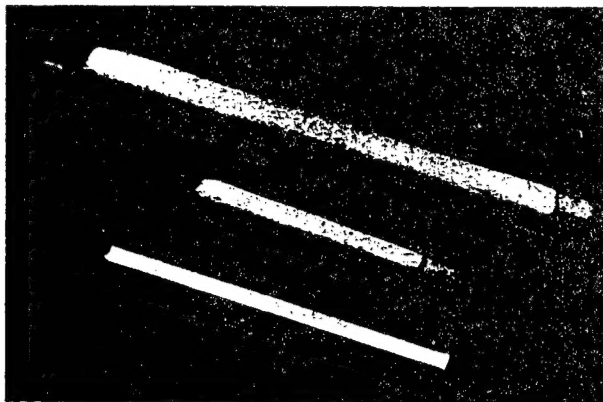

Figure 1. Platinum Precision Resistors (at bottom is a match for comparison)

Such a configuration is called a resistance thermometer. The VEB Thermometerwerk Geraberg manufactures a wide variety of such resistance thermometers with a range of measurement between -200 and 550°C.

Dynamic response is of basic interest in terms of evaluating the quality of a temperature sensor. If a temperature sensor is exposed to a jump in temperature, the output values do not fall into step immediately but rather approach the final value asymptotically. These processes of compensation can be described in terms of the step function with respect to time and the transfer function with respect to frequency. The time constant T is commonly used to express the dynamic response. T is defined as the time required by a sensor for its output values to approach the initial jump by 63.2 percent of the final value. It must also be noted in this regard that dynamic measuring errors can be corrected by downstream electrical networks.

Internationally, such sensors are also known as RTD (resistance temperature detector) sensors. For further processing of the test value, resistance thermometers are commonly connected as part of a Wheatstone bridge. Three-wire circuits are frequently used in order to eliminate the effects of line resistance. The initial parameter obtained is a temperature-dependent voltage. The VEB Messgeraetewerk "Erich Weinert" Magdeburg has combined a resistance thermometer and a transducer unit into the CC-F 12 resistance transmitter. The CC-F 2 pickup transmitter from the same manufacturer contains only the transducer unit.

Since the manufacture of Pt precision resistors is expensive and labor-intensive, international efforts have taken place within recent years to develop substitutes based on thin-film and thick-film technology.

At the VEB Elektro-Apparate-Werk Berlin-Treptow, for example, a thick-film temperature sensor (PTC-DTS) was developed. Borrowing from the Pt 100, the freezing-point resistance was set to 100 Ω. The sensor can be adjusted for a temperature range of -40°C to 140°C. The characteristic curve shows good linearity within the specified range. Advantages of these sensors (Fig. 2) are that industrial mass production is possible, their manufacture requires no platinum and therefore the price is low. PTC sensors are a component of the CC-F 1 resistance transmitter from the above-mentioned manufacturer.
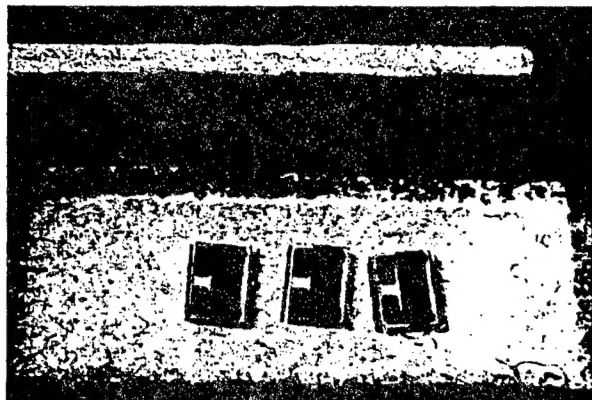

Figure 2. Thick-Film Temperature Sensor

This is a U.S. Government publication. Its contents in no way represent the policies, views, or attitudes of the U.S. Government. Users of this publication may cite FBIS or JPRS provided they do so in a manner clearly identifying them as the secondary source.

Foreign Broadcast Information Service (FBIS) and Joint Publications Research Service (JPRS) publications contain political, economic, military, and sociological news, commentary, and other information, as well as scientific and technical data and reports. All information has been obtained from foreign radio and television broadcasts, news agency transmissions, newspapers, books, and periodicals. Items generally are processed from the first or best available source; it should not be inferred that they have been disseminated only in the medium, in the language, or to the area indicated. Items from foreign language sources are translated; those from English-language sources are transcribed, with personal and place names rendered in accordance with FBIS transliteration style.

Headlines, editorial reports, and material enclosed in brackets [ ] are supplied by FBIS/JPRS. Processing indicators such as [Text] or [Excerpts] in the first line of each item indicate how the information was processed from the original. Unfamiliar names rendered phonetically are enclosed in parentheses. Words or names preceded by a question mark and enclosed in parentheses were not clear from the original source but have been supplied as appropriate to the context. Other unattributed parenthetical notes within the body of an item originate with the source. Times within items are as given by the source. Passages in boldface or italics are as published.

SUBSCRIPTION/PROCUREMENT INFORMATION

The FBIS DAILY REPORT contains current news and information and is published Monday through Friday in eight volumes: China, East Europe, Soviet Union, East Asia, Near East & South Asia, Sub-Saharan Africa, Latin America, and West Europe. Supplements to the DAILY REPORTs may also be available periodically and will be distributed to regular DAILY REPORT subscribers. JPRS publications, which include approximately 50 regional, worldwide, and topical reports, generally contain less time-sensitive information and are published periodically.

Current DAILY REPORTs and JPRS publications are listed in *Government Reports Announcements* issued semimonthly by the National Technical Information Service (NTIS), 5285 Port Royal Road, Springfield, Virginia 22161 and the *Monthly Catalog of U.S. Government Publications* issued by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

The public may subscribe to either hardcover or microfiche versions of the DAILY REPORTs and JPRS publications through NTIS at the above address or by calling (703) 487-4630. Subscription rates will be

provided by NTIS upon request. Subscriptions are available outside the United States from NTIS or appointed foreign dealers. New subscribers should expect a 30-day delay in receipt of the first issue.

U.S. Government offices may obtain subscriptions to the DAILY REPORTs or JPRS publications (hardcover or microfiche) at no charge through their sponsoring organizations. For additional information or assistance, call FBIS, (202) 338-6735,or write to P.O. Box 2604, Washington, D.C. 20013. Department of Defense consumers are required to submit requests through appropriate command validation channels to DIA, RTS-2C, Washington, D.C. 20301. (Telephone: (202) 373-3771, Autovon: 243-3771.)

Back issues or single copies of the DAILY REPORTs and JPRS publications are not available. Both the DAILY REPORTs and the JPRS publications are on file for public reference at the Library of Congress and at many Federal Depository Libraries. Reference copies may also be seen at many public and university libraries throughout the United States.